APPENDIX J:

GRAPHICAL REPRESENTATION OF THE SOURCE APPORTIONMENT RESULTS FOR ST. LOUIS, MISSOURI

Appendix J: Graphical Representation of the Source Apportionment Results for St. Louis, Missouri

This appendix shows a series of nine plots for each source indicated by the PMF model for St. Louis, Missouri. These plots are used to help identify the sources by understanding some of the characteristics of the sources. The plots included for each source are:

1. The source profile plot.
2. The time series of the source strength.
3. Bar charts of the source strength for various categories.
4. The source pollution rose.
5. The source region(s) as indicated by the source contribution function.
6. The source region(s) as indicated by the incremental probability function.
7. Back trajectories color coded by source strength.
8. Scatter plots of the source strength versus ambient temperature for each season and scatter plots of the source strength versus ambient pressure.

The profile plot shows the relative composition of the source (bars with the scale on the left) and the percent of the total species mass observed at the receptor attributed to the source (line with the scale on the right). The relative chemical composition is the main basis for the source identifications. Generally, the other plots are used to refine or confirm the identification made from this first plot.

The time series plot shows the source strength as a function of time. Two scales are shown. On the left is the source strength in $\mu g/m^3$ and on the right is the relative source strength, which is the daily source strength divided by the mean source strength. The latter is the direct output from the PMF model and can be used to compare events among sources.

The bar charts show the mean source strength when stratified by wind speed (including calm periods), weekday/weekend, and season (winter is December, January, and February). Each of these plots provides supplemental information for identifying the source.

The pollution rose shows the mean source strength by wind sector and wind speed category. These plots can indicate the source location for local sources. Winds less than 1 mph are not used in generating this plot, since the wind direction is not always clear for low winds. These periods are indicated in the bar charts.

The next two plots are the source regions as indicated by either the source contribution function (the probability of a high source day given that the back trajectory passes over the grid point) or the incremental probability function (the probability that source strength is high and the back trajectory passes over the grid point minus the probability that the back trajectory passes over the grid point). High and low days are defined as above. To minimize the effects of having too few trajectories within a grid cell, the plots for the source contribution function are of a lower bound for a 90 percent confidence interval for the probability of a high day. Hence, only the

areas that have a probability that is significantly above 20 percent are plotted. For the incremental probability plot, this same effect is avoided by dividing the incremental probability by its standard error and plotting the regions that are at least 1 standard error away from zero (in either direction). These modifications to the usual source contribution function and the incremental probability make it easier to compare the plots and the numerical values among different sources.

The back trajectory plots are color coded by source strength. The low source strength days are blue and represent the lowest 20 percent of the source strengths. The high source days are red and represent the highest 20 percent of the source strengths. The remainder of the back trajectories are plotted in green. These can give some indication of source region, but are usually too messy for that purpose. The main use for these plots is as noted above; they show when the effects of high pressure systems play a significant role in the source strength.

The first set of scatter plots shows any relationship between ambient temperature and the source strength. The plots are separated by season to keep extreme observations from dominating the relationship. Underneath these plots is a scatter plot that shows any relationship between local ambient pressure and the source strength. Very few sources show a relationship since source activity is rarely related to pressure. The source strength are more often modulated by the concentrating effects of high pressure systems located tangent to the site. These should be compared to the back trajectories for high source days (the previous plot). The back trajectories around high pressure systems will be clockwise ending at the receptor. Generally, the other source strength plots, in particular the remaining back trajectory source region plots, need to be discounted for this effect when it is present.

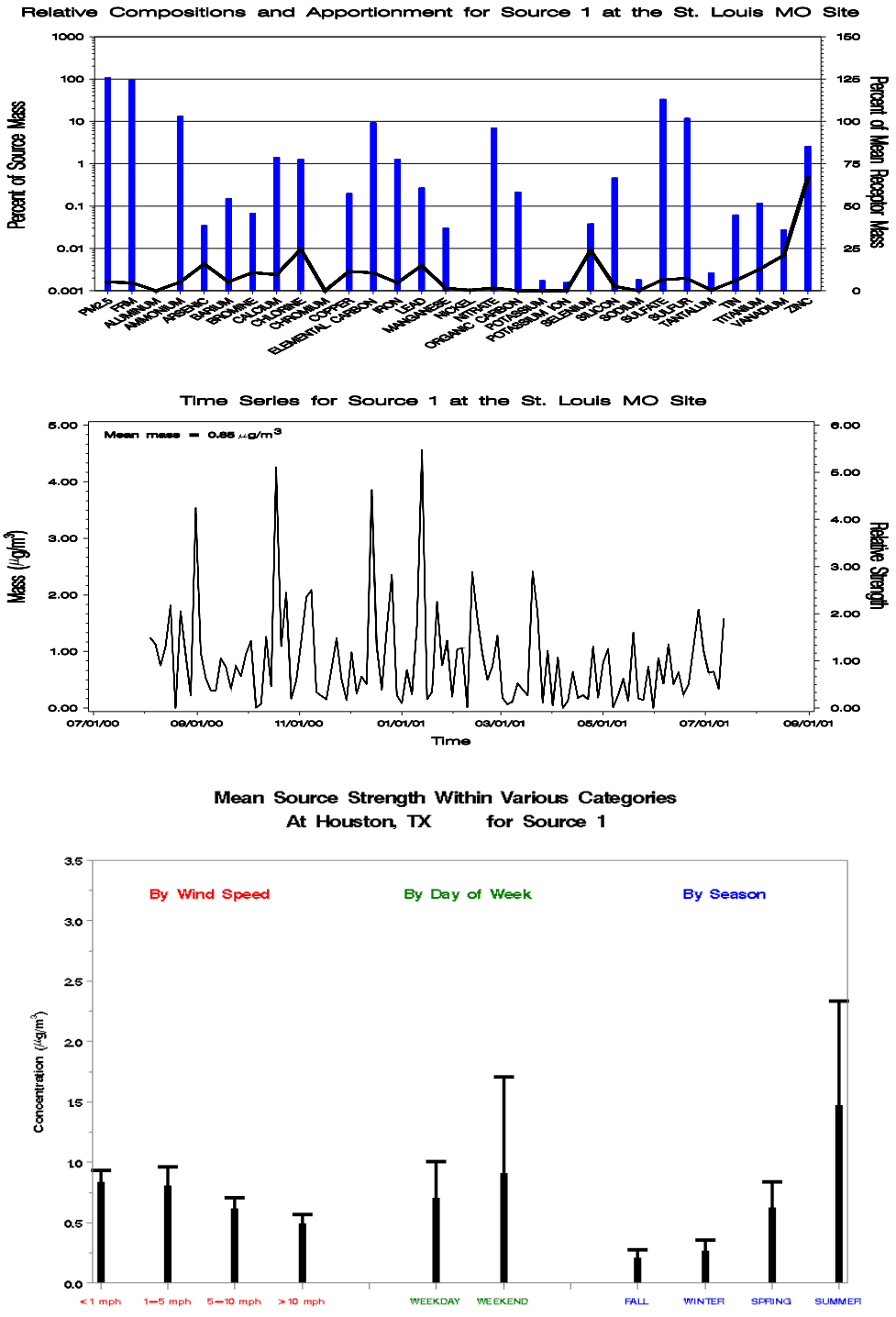

Figure J-1. Profile Plot (Top), Time Series Plot (Middle), and Bar Charts of the Source Strength Averaged by Wind Speed, Day of Week, and Season (Bottom) for St. Louis, Missouri, Source 1 - Zinc Refinery.

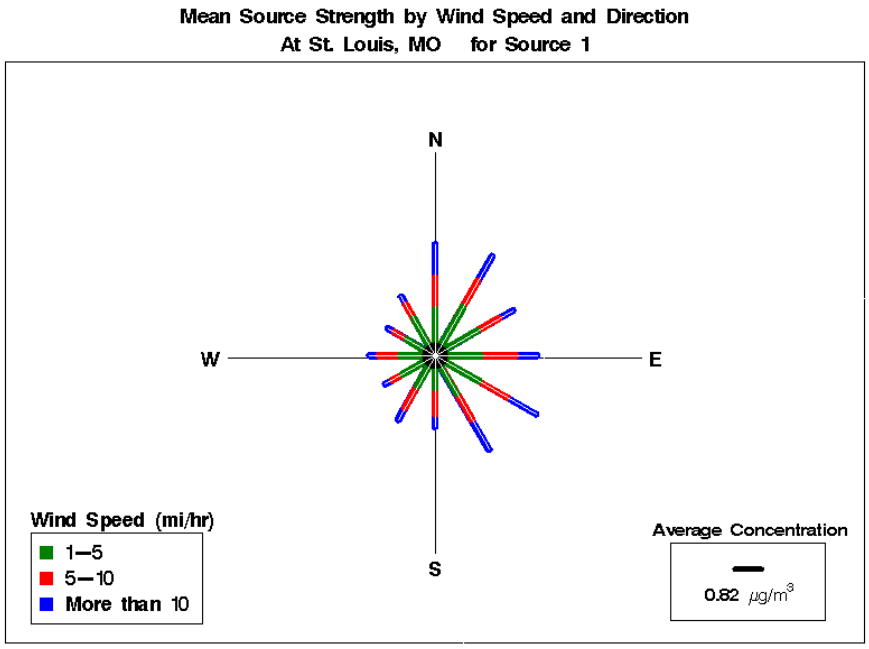

Figure J-2. Pollution Rose for St. Louis, Missouri, Source 1 - Zinc Refinery.

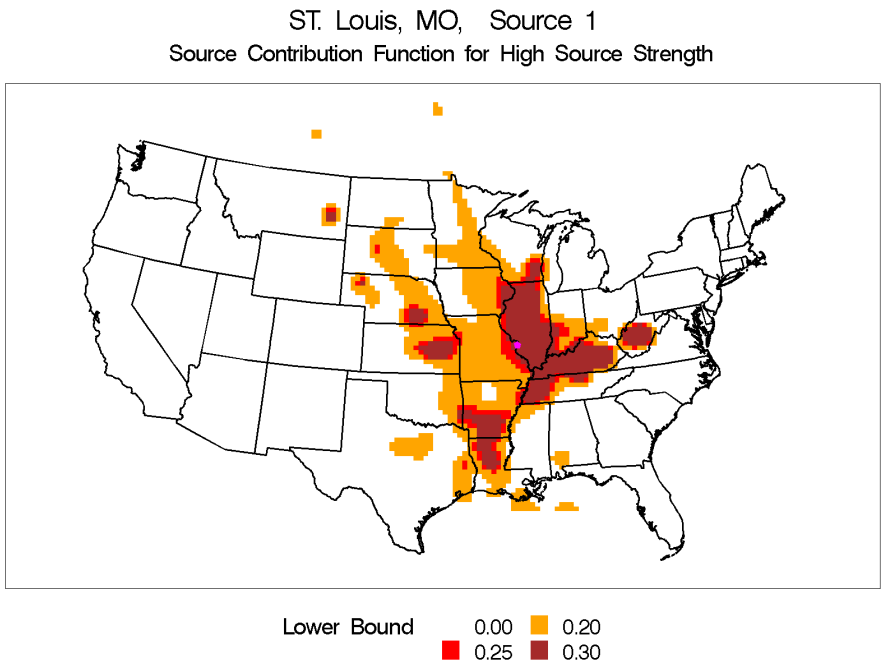

Figure J-3 Source Contribution Contour Plot for St. Louis, Missouri, Source 1 - Zinc Refinery.

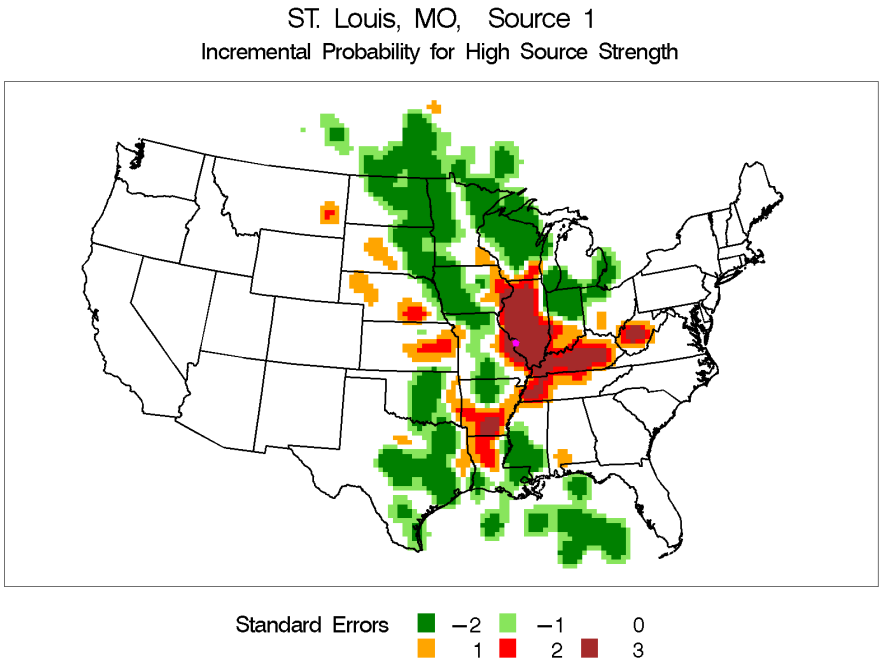

Figure J-4 Incremental Probability Contour Plot for St. Louis, Missouri, Source 1 - Zinc Refinery.

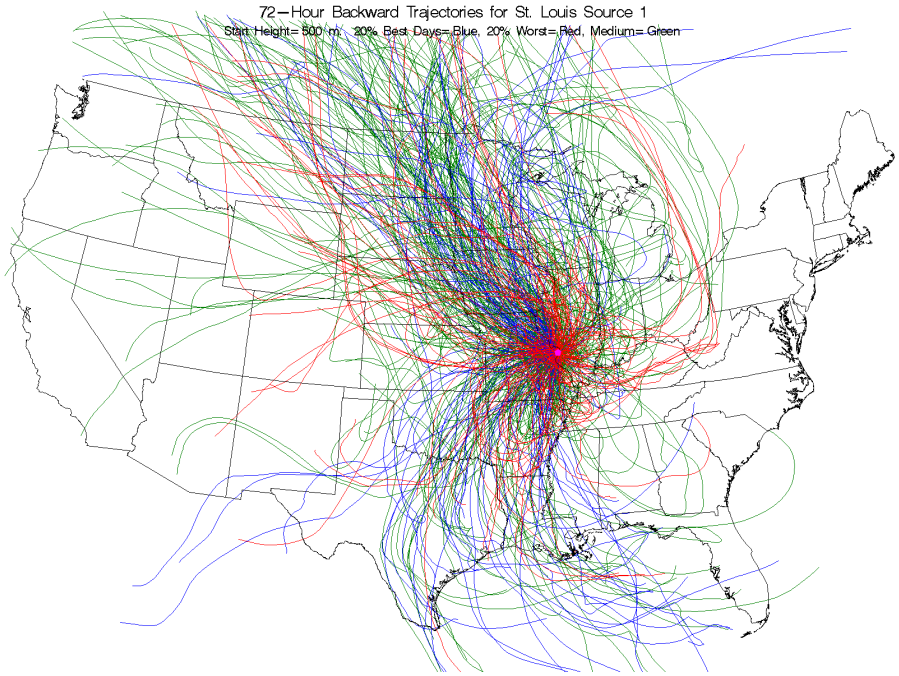

Figure J-5 Back Trajectories Color Coded by Source Strength Category for St. Louis, Missouri, Source 1 - Zinc Refinery.

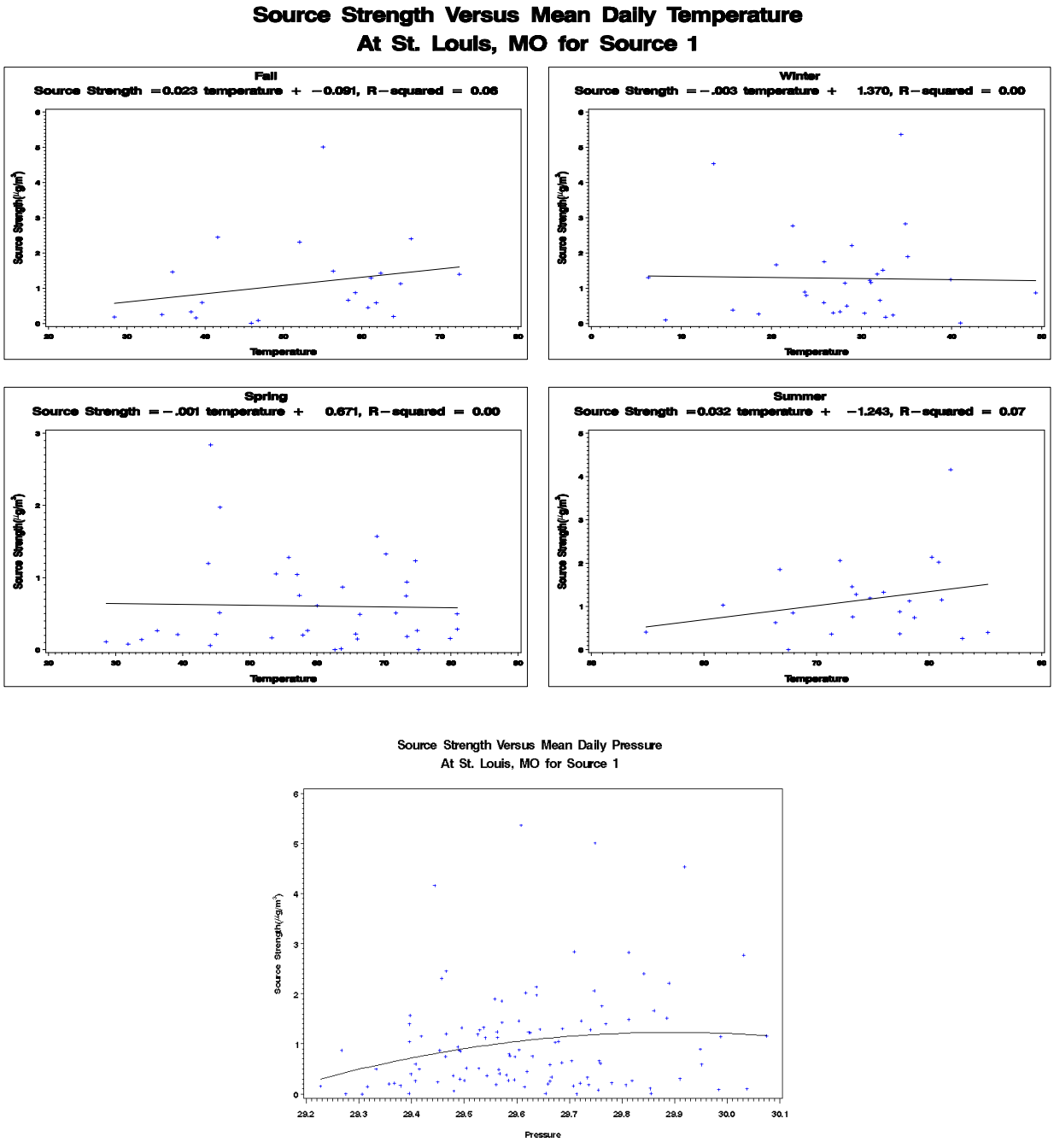

Figure J-6 Scatter Plot of Source Strength Versus Mean Daily Temperature (Rows 1 and 2) and Pressure (bottom) for St. Louis, Missouri, Source 1 - Zinc Refinery.

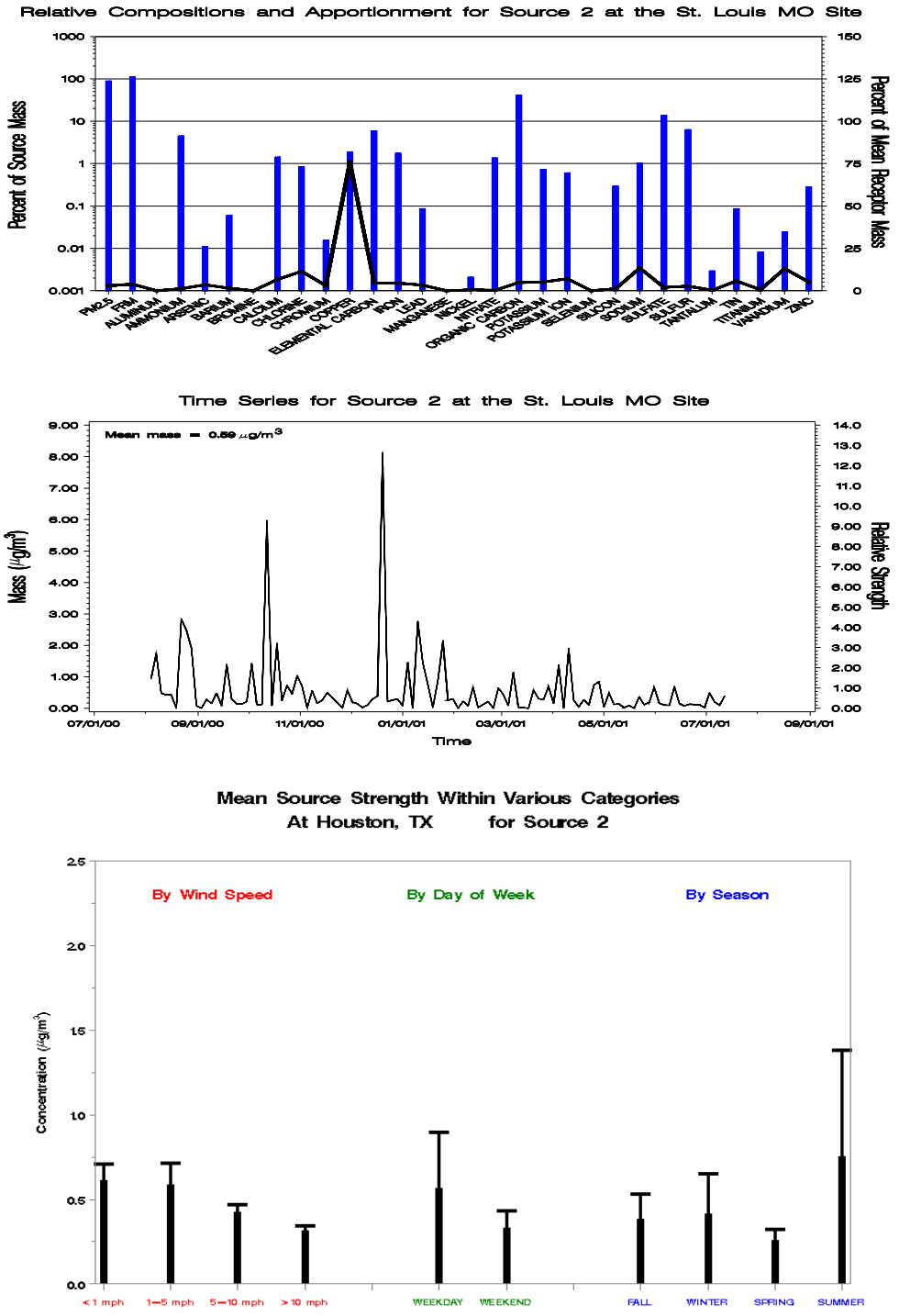

Figure J-7. Profile Plot (Top), Time Series Plot (Middle), and Bar Charts of the Source Strength Averaged by Wind Speed, Day of Week, and Season (Bottom) for St. Louis, Missouri, Source 2 - Smelting (Copper).

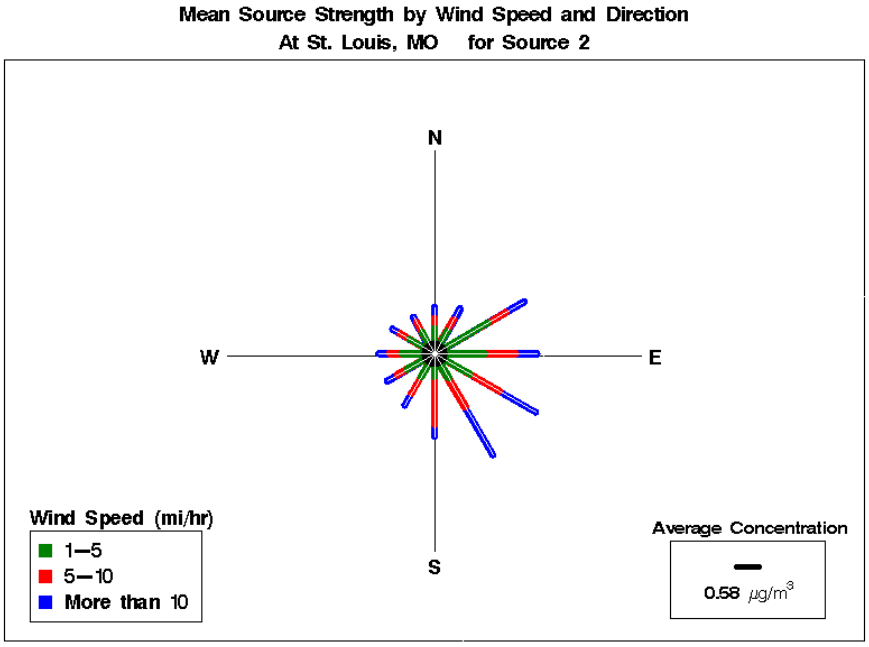

Figure J-8 Pollution Rose for St. Louis, Missouri, Source 2 - Smelting (Copper).

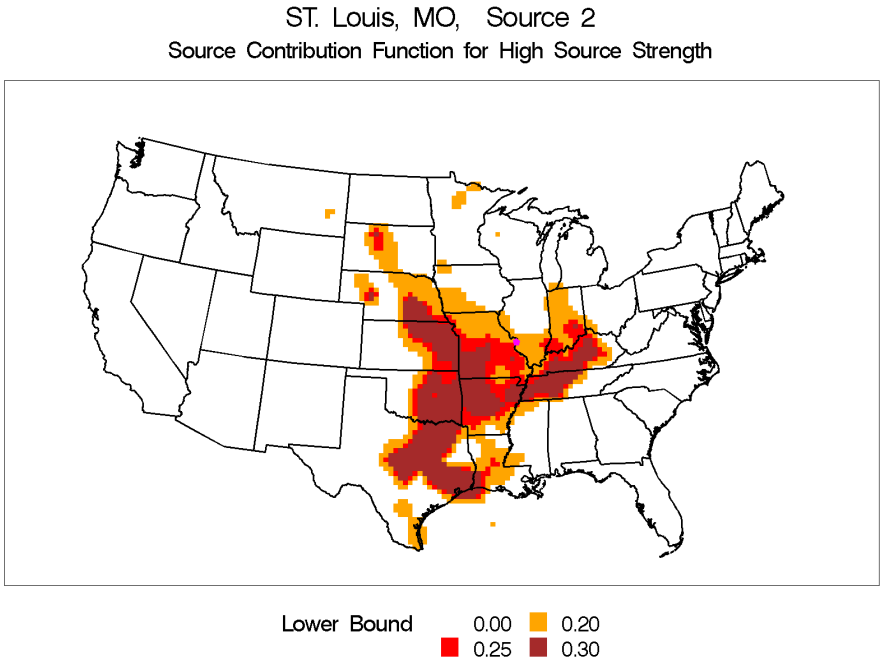

Figure J-9 Source Contribution Contour Plot for St. Louis, Missouri, Source 2 - Smelting (Copper).

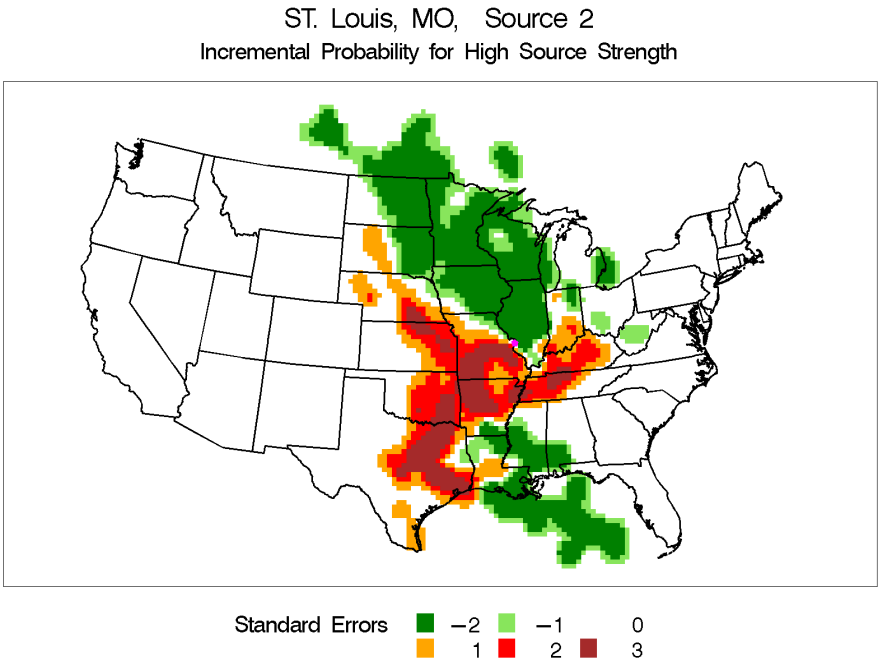

Figure J-10 Incremental Probability Contour Plot for St. Louis, Missouri, Source 2 - Smelting (Copper).

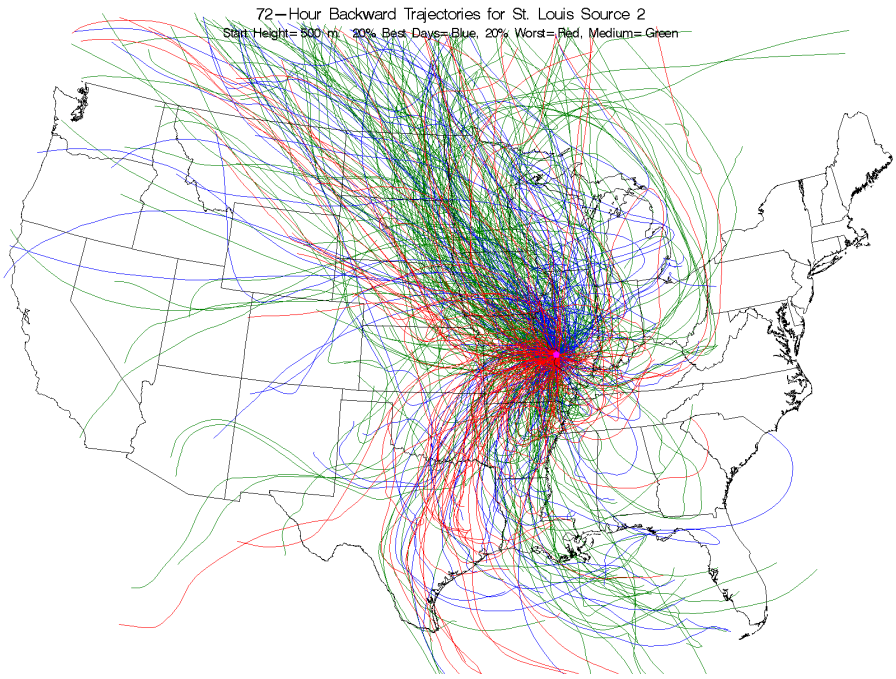

Figure J-11 Back Trajectories Color Coded by Source Strength Category for St. Louis, Missouri, Source 2 - Smelting (Copper).

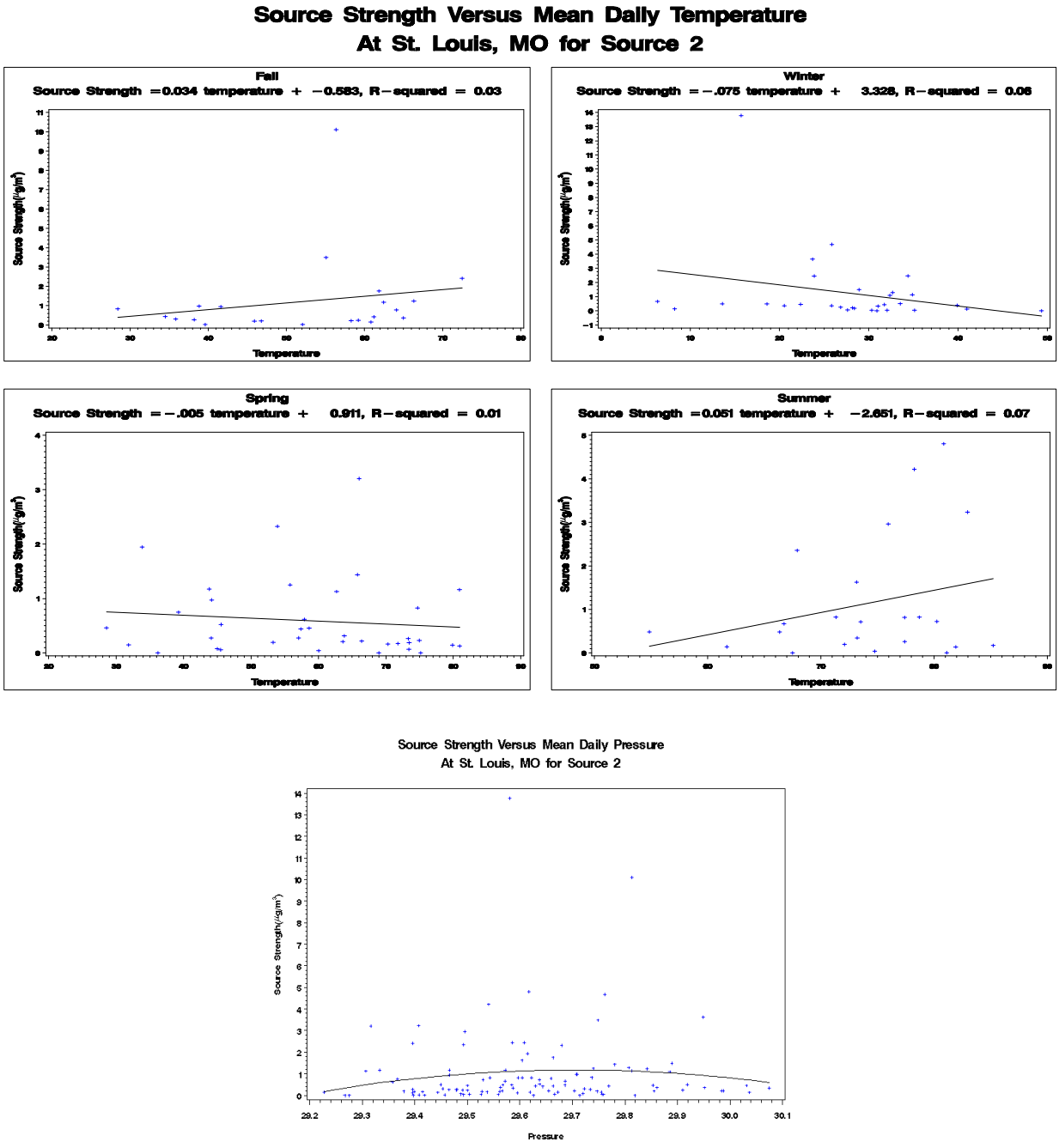

Figure J-12 Scatter Plot of Source Strength Versus Mean Daily Temperature (Rows 1 and 2) and Pressure (bottom) for St. Louis, Missouri, Source 2 - Smelting (Copper).

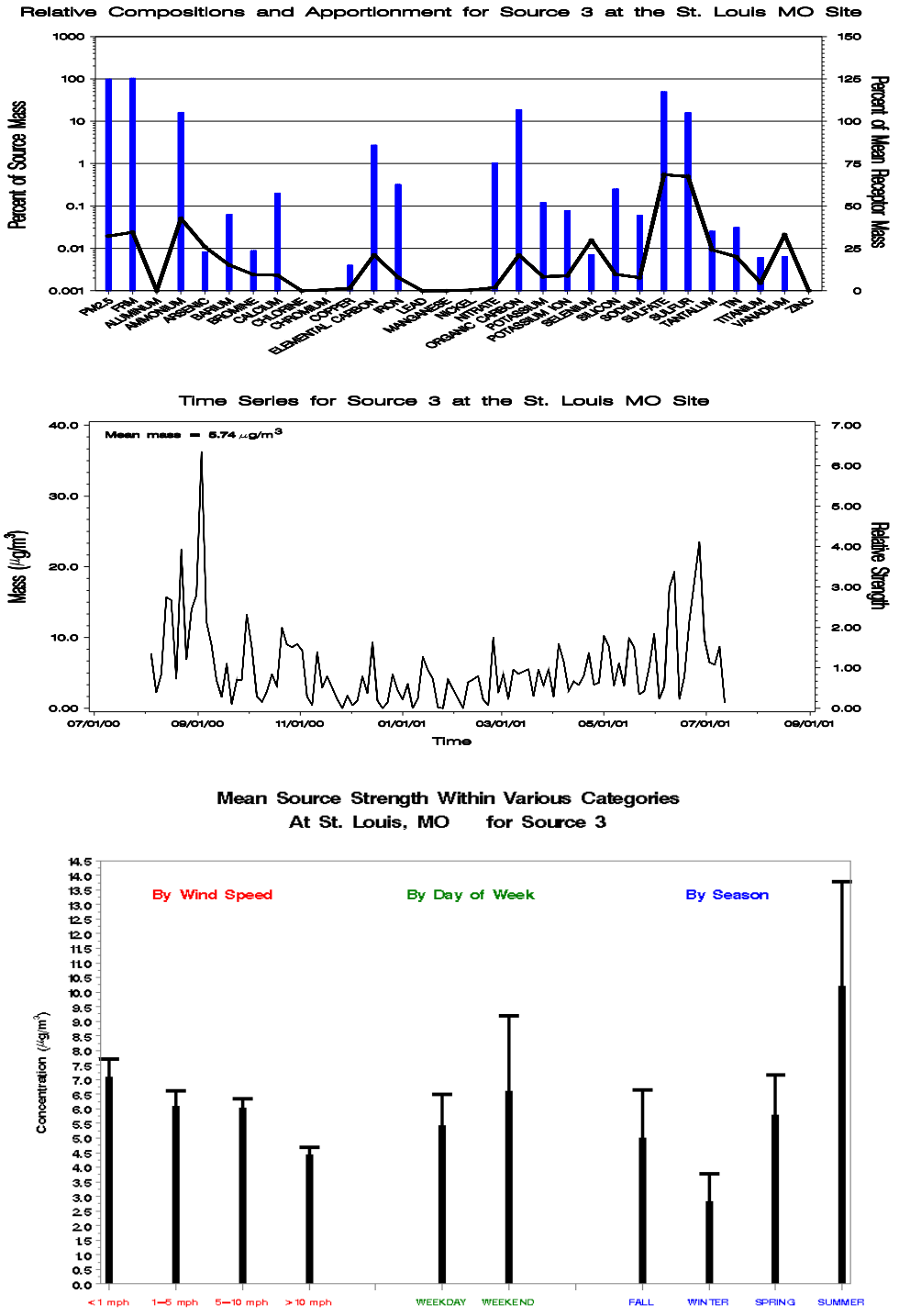

Figure J-13 Profile Plot (Top), Time Series Plot (Middle), and Bar Charts of the Source Strength Averaged by Wind Speed, Day of Week, and Season (Bottom) for St. Louis, Missouri, Source 3 - Coal Combustion.

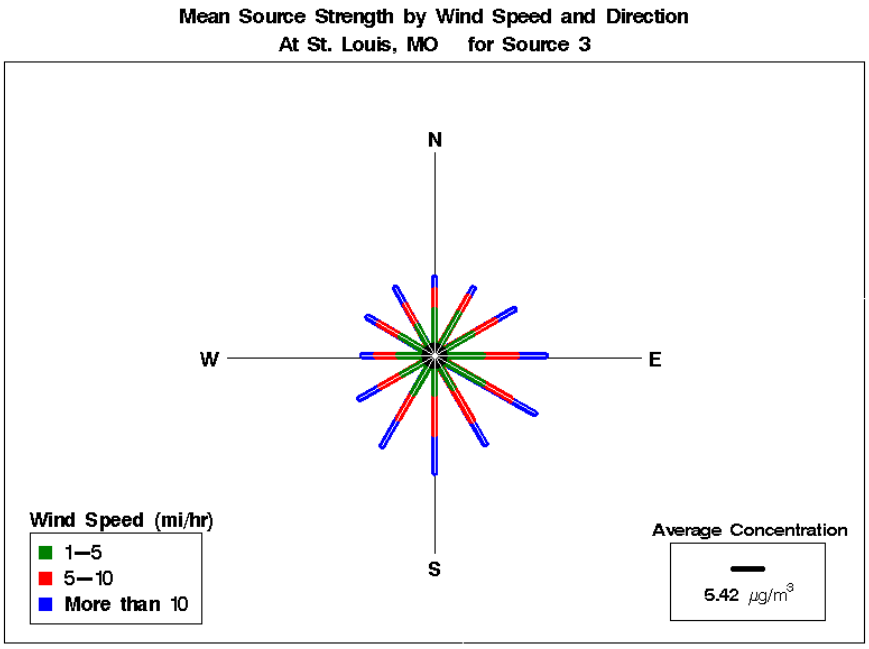

Figure J-14 Pollution Rose for St. Louis, Missouri, Source 3 - Coal Combustion.

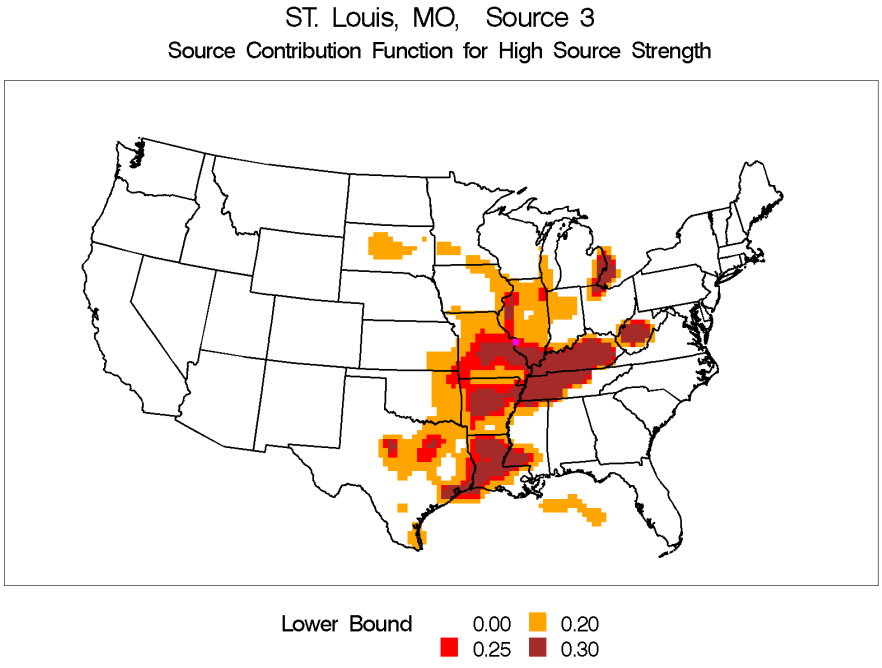

Figure J-15 Source Contribution Contour Plot for St. Louis, Missouri, Source 3 - Coal Combustion.

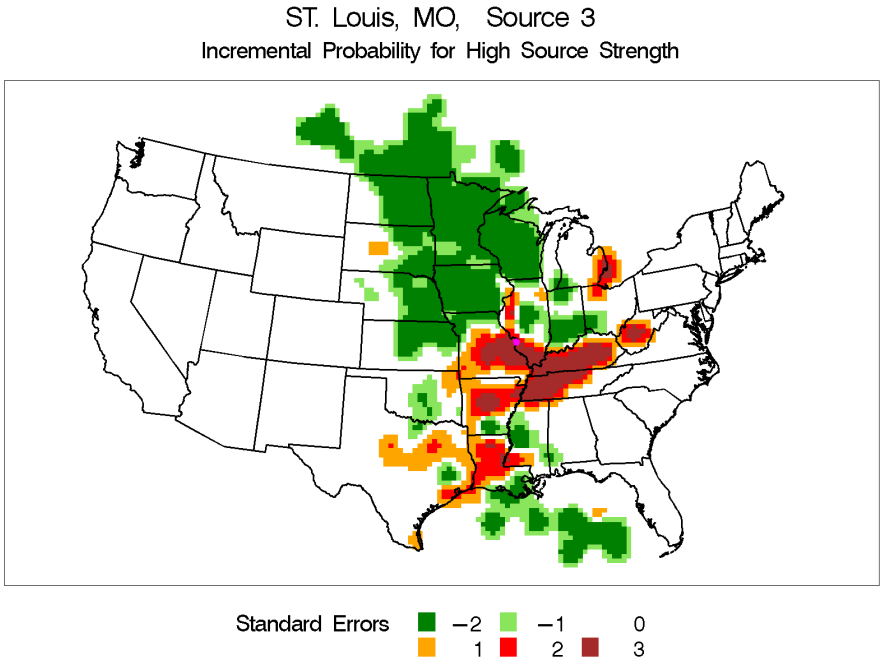

Figure J-16 Incremental Probability Contour Plot for St. Louis, Missouri, Source 3 - Coal Combustion.

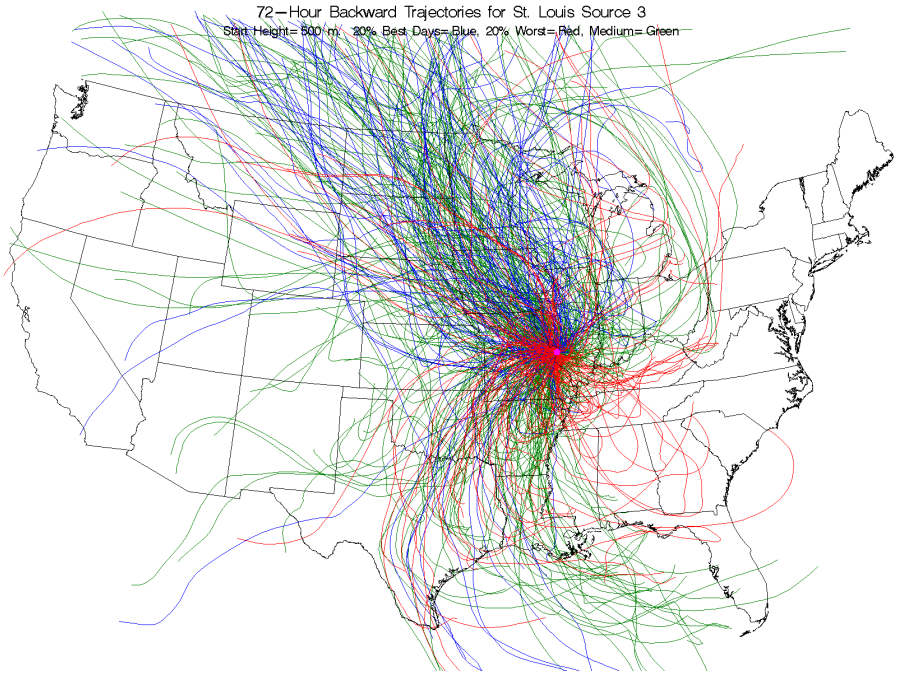

Figure J-17 Back Trajectories Color Coded by Source Strength Category for St. Louis, Missouri, Source 3 - Coal Combustion.

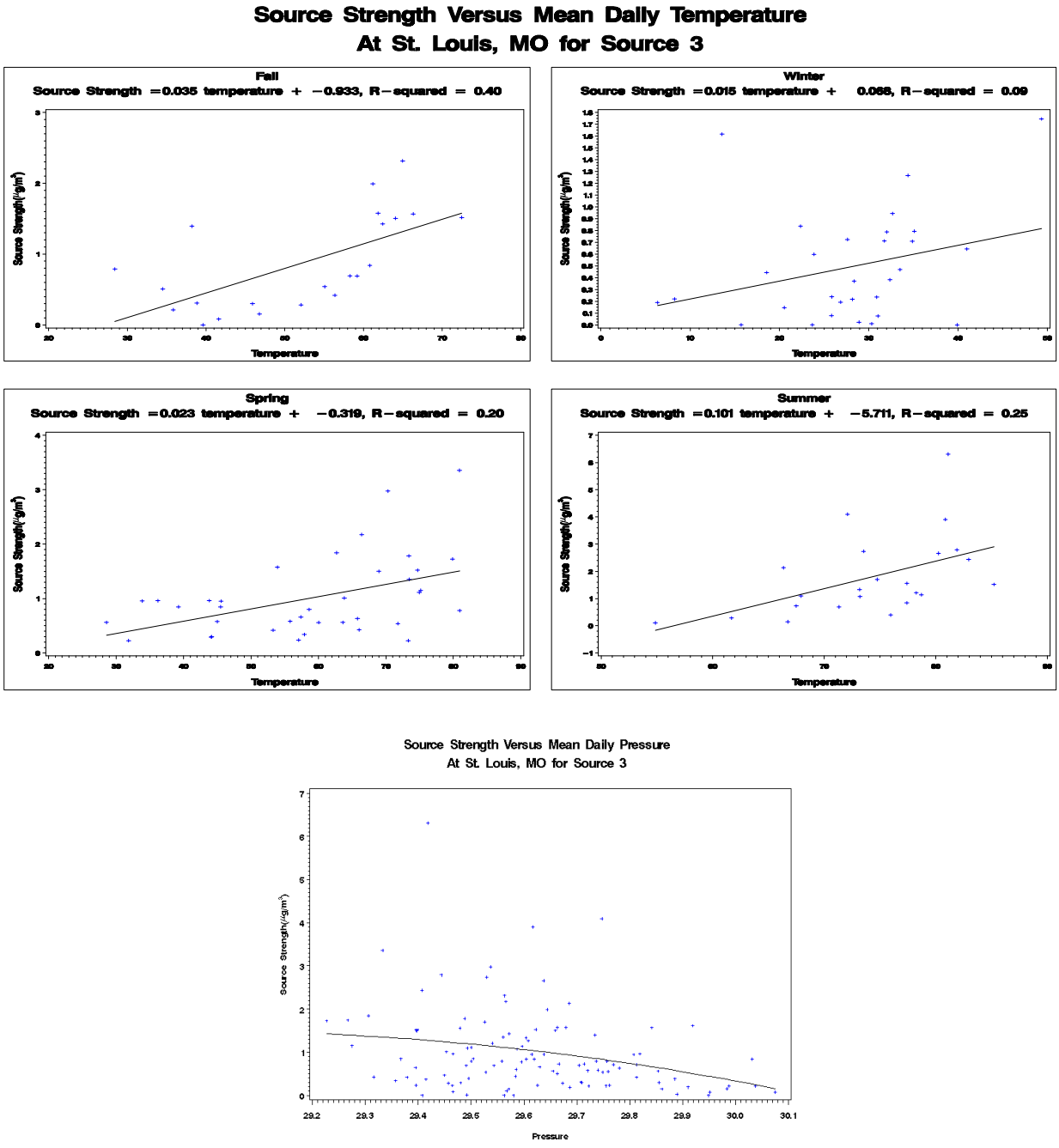

Figure J-18 Scatter Plot of Source Strength Versus Mean Daily Temperature (Rows 1 and 2) and Pressure (bottom) for St. Louis, Missouri, Source 3 - Coal Combustion.

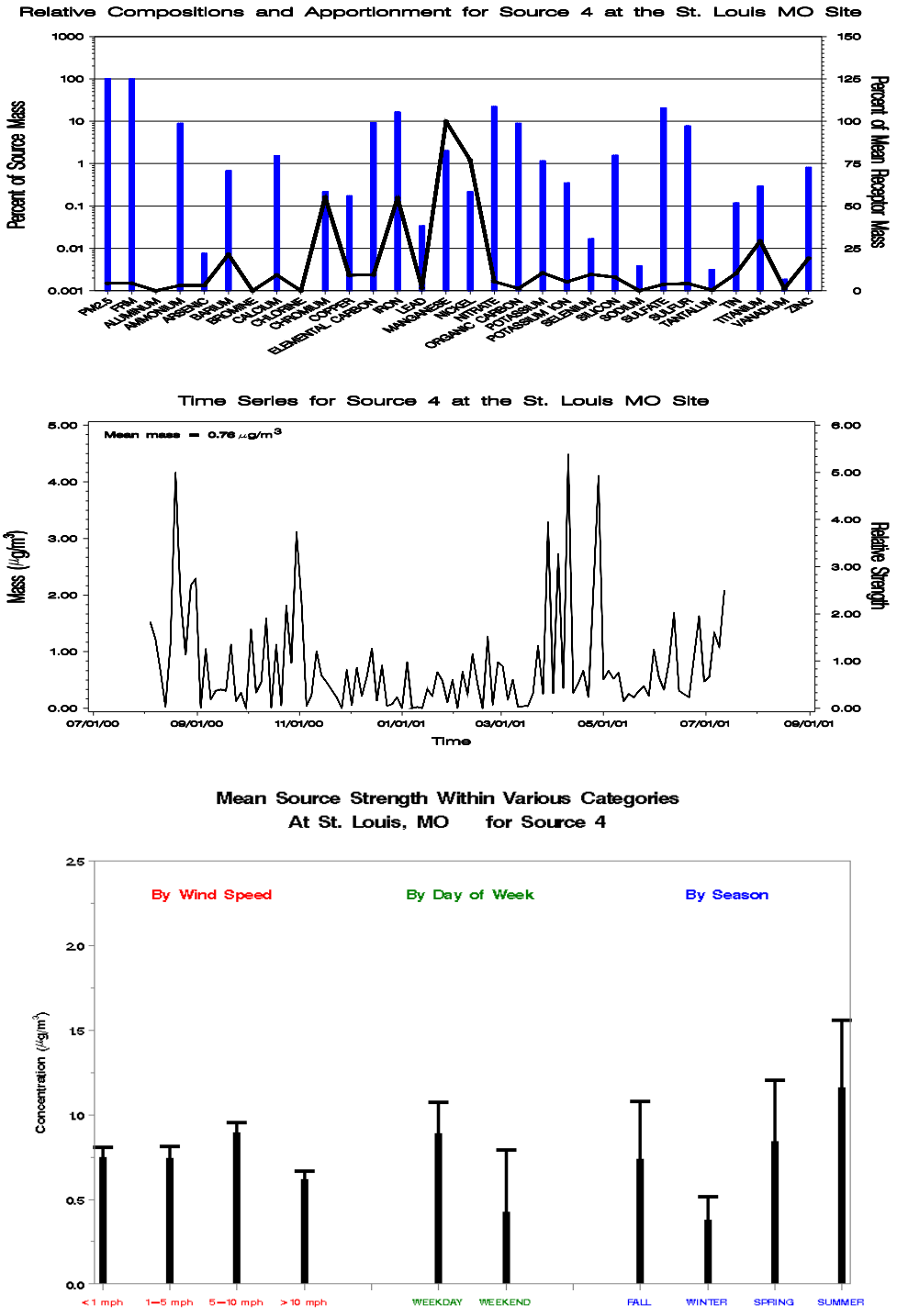

Figure J-19 Profile Plot (Top), Time Series Plot (Middle), and Bar Charts of the Source Strength Averaged by Wind Speed, Day of Week, and Season (Bottom) for St. Louis, Missouri, Source 4 - Steel Production.

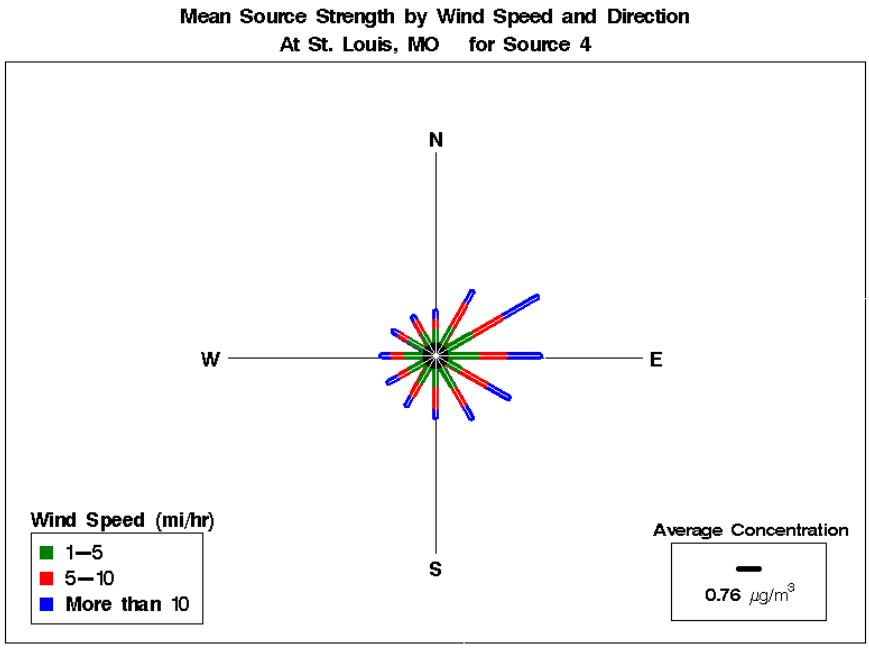

Figure J-20 Pollution Rose for St. Louis, Missouri, Source 4 - Steel Production.

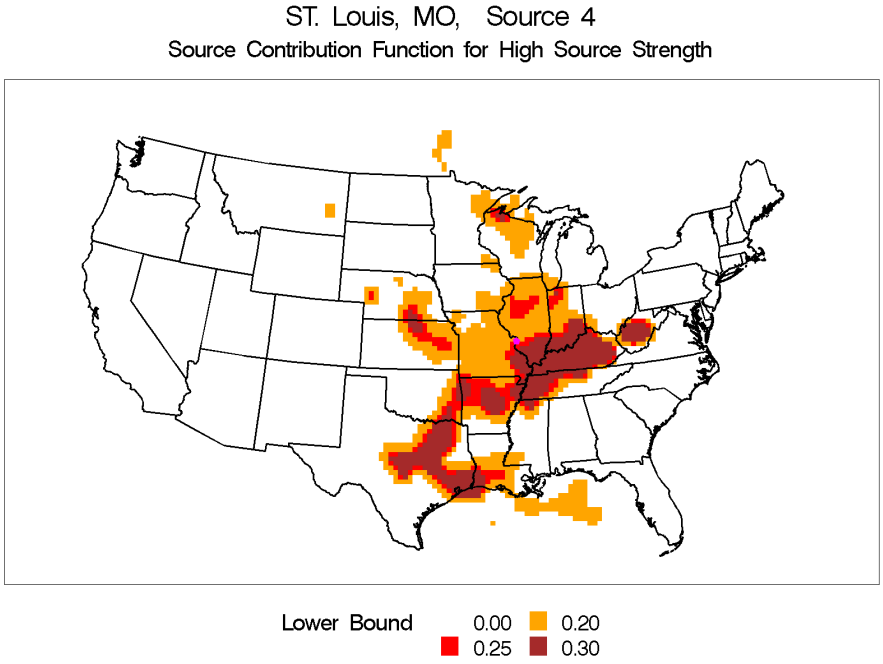

Figure J-21 Source Contribution Contour Plot for St. Louis, Missouri, Source 4 - Steel Production.

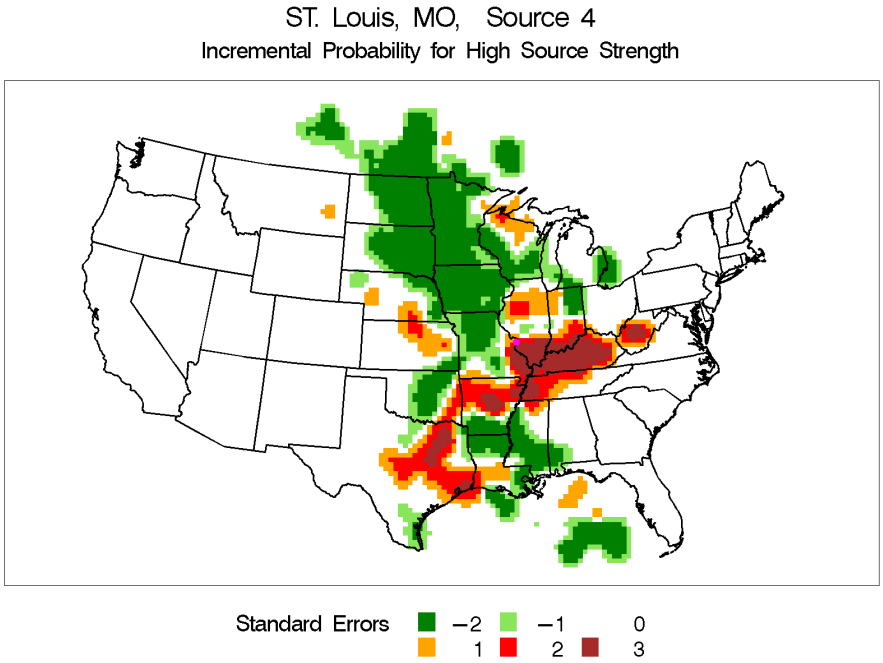

Figure J-22 Incremental Probability Contour Plot for St. Louis, Missouri, Source 4 - Steel Production.

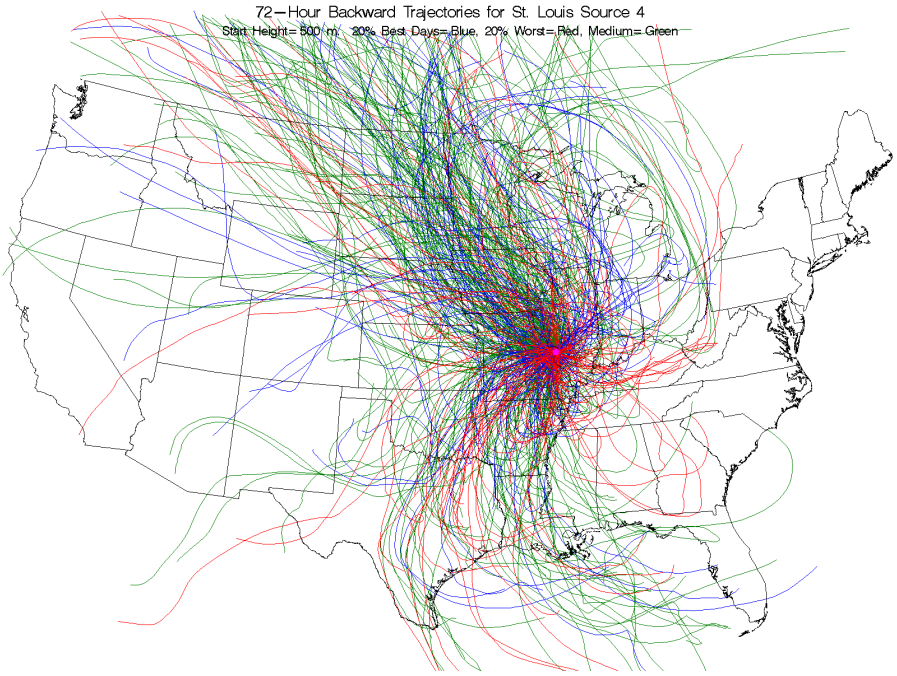

Figure J-23 Back Trajectories Color Coded by Source Strength Category for St. Louis, Missouri, Source 4 - Steel Production.

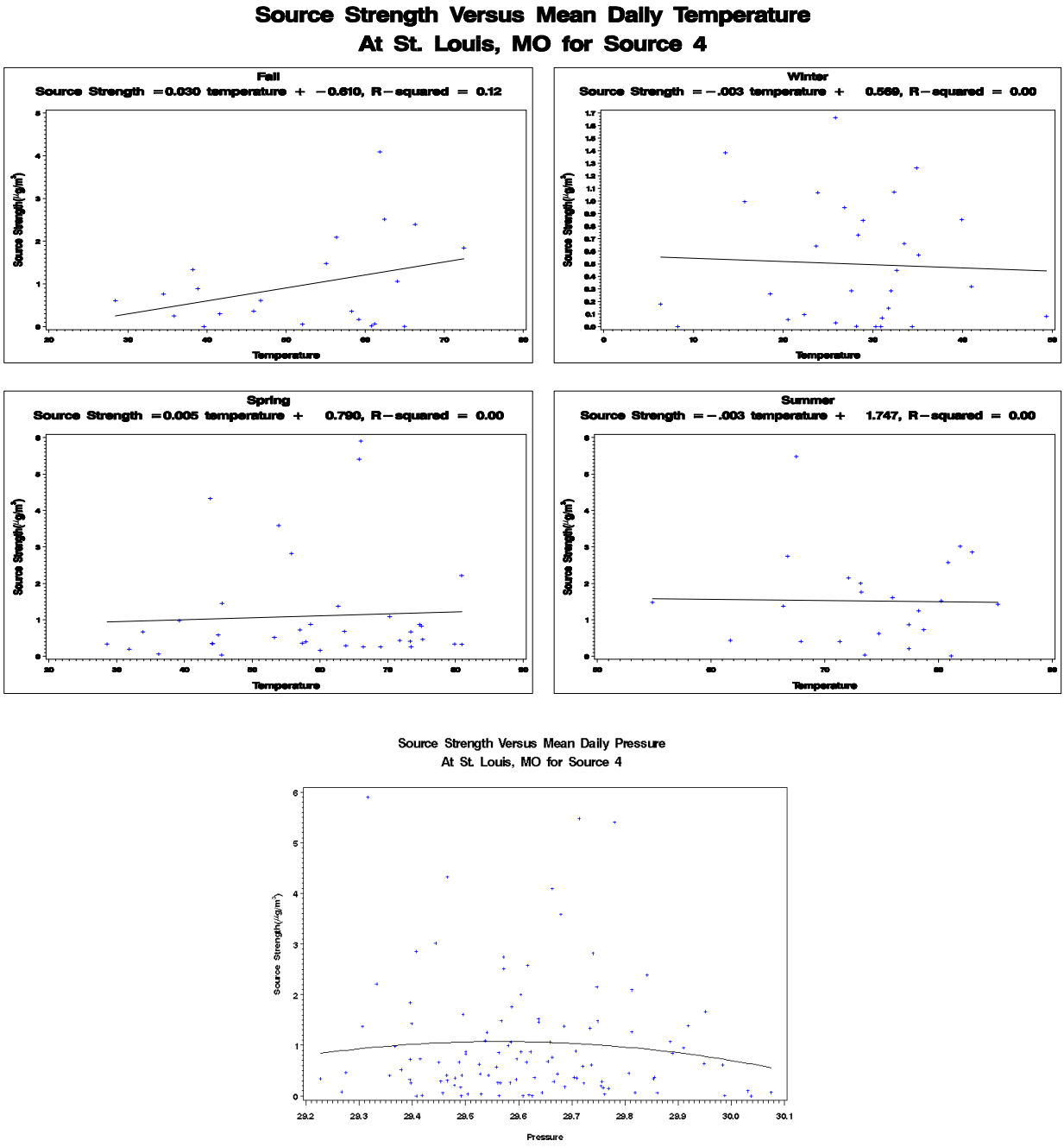

Figure J-24 Scatter Plot of Source Strength Versus Mean Daily Temperature (Rows 1 and 2) and Pressure (bottom) for St. Louis, Missouri, Source 4 - Steel Production.

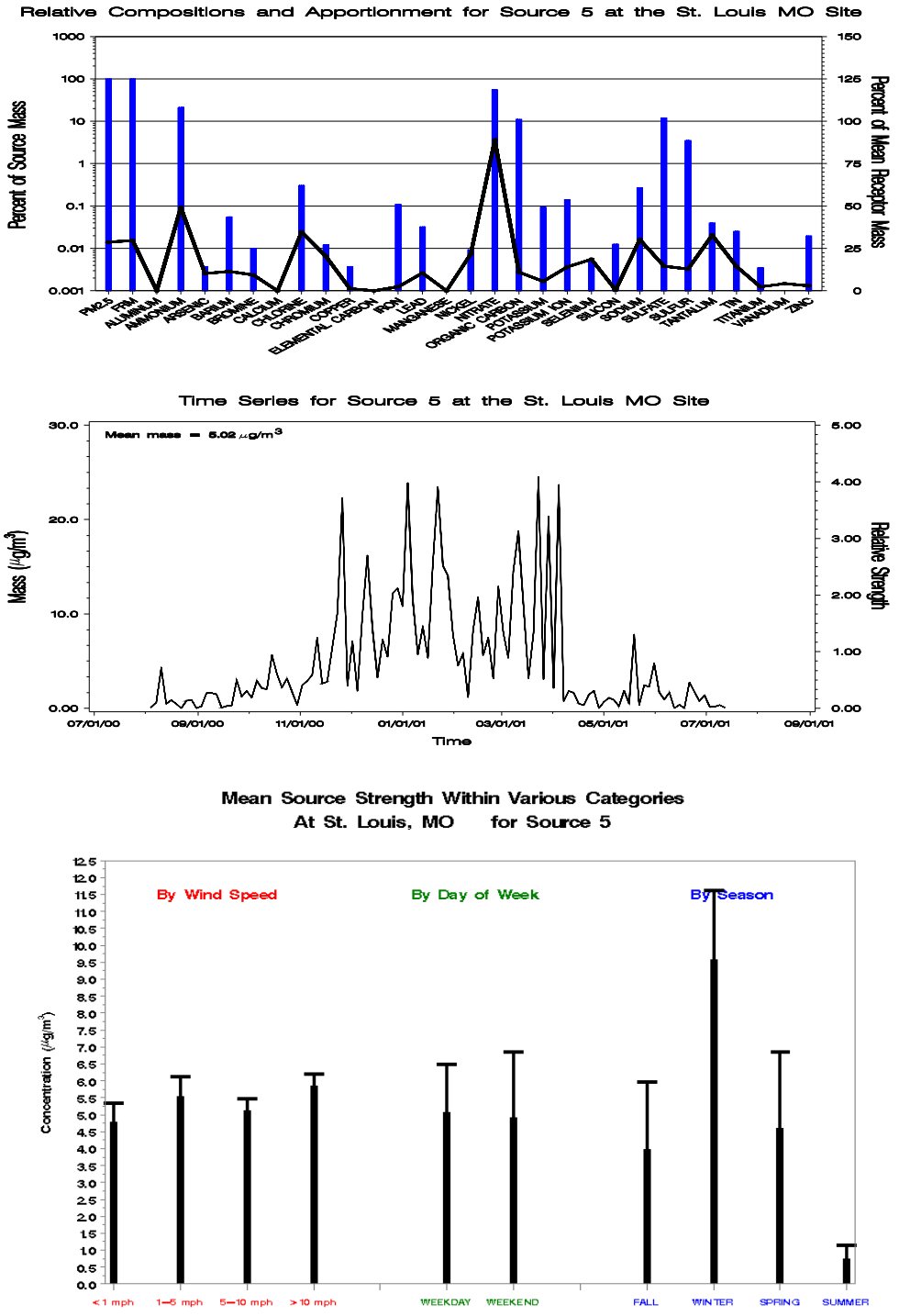

Figure J-25 Profile Plot (Top), Time Series Plot (Middle), and Bar Charts of the Source Strength Averaged by Wind Speed, Day of Week, and Season (Bottom) for St. Louis, Missouri, Source 5 - Ammonium Nitrate.

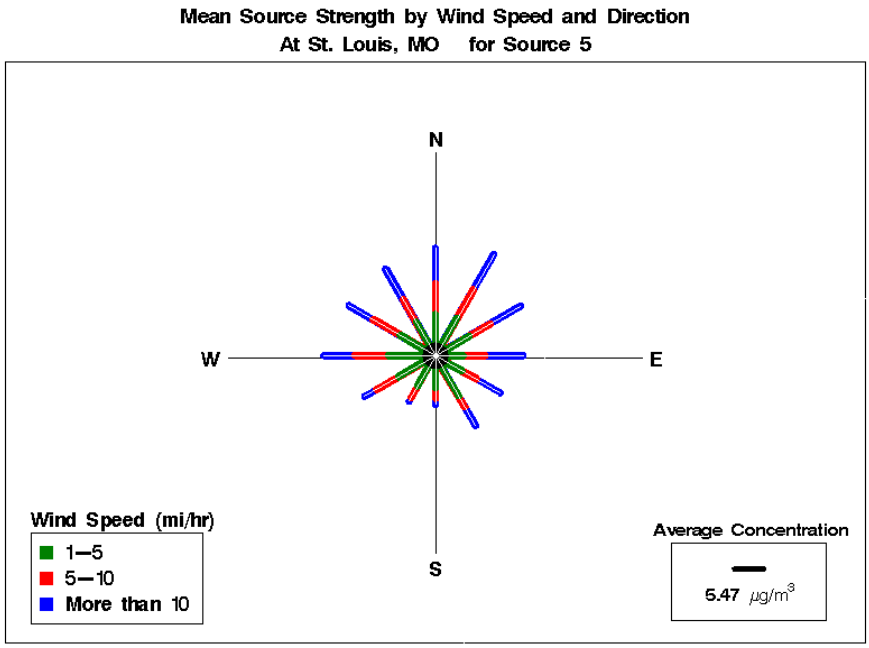

Figure J-26 Pollution Rose for St. Louis, Missouri, Source 5 - Ammonium Nitrate.

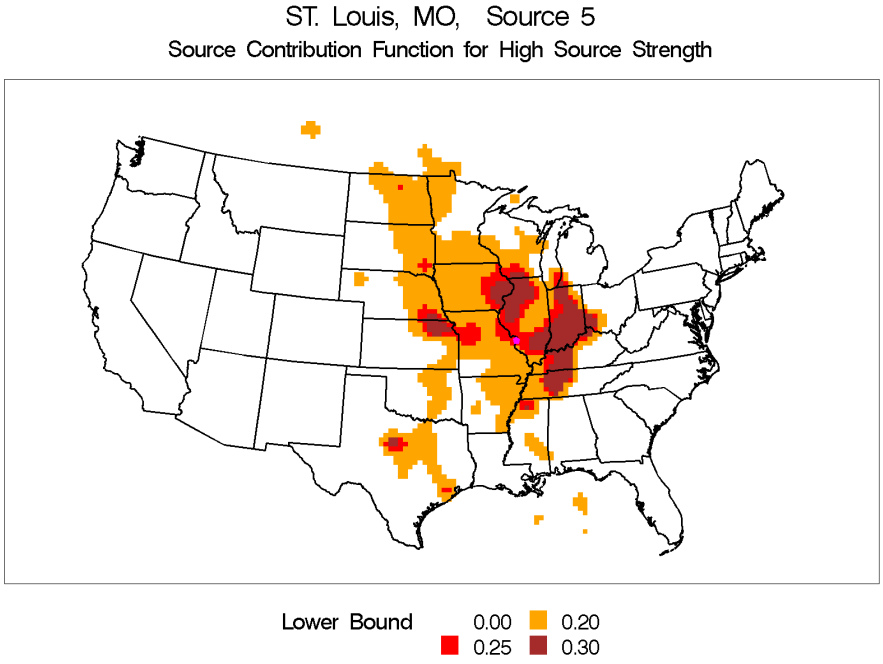

Figure J-27 Source Contribution Contour Plot for St. Louis, Missouri, Source 5 - Ammonium Nitrate.

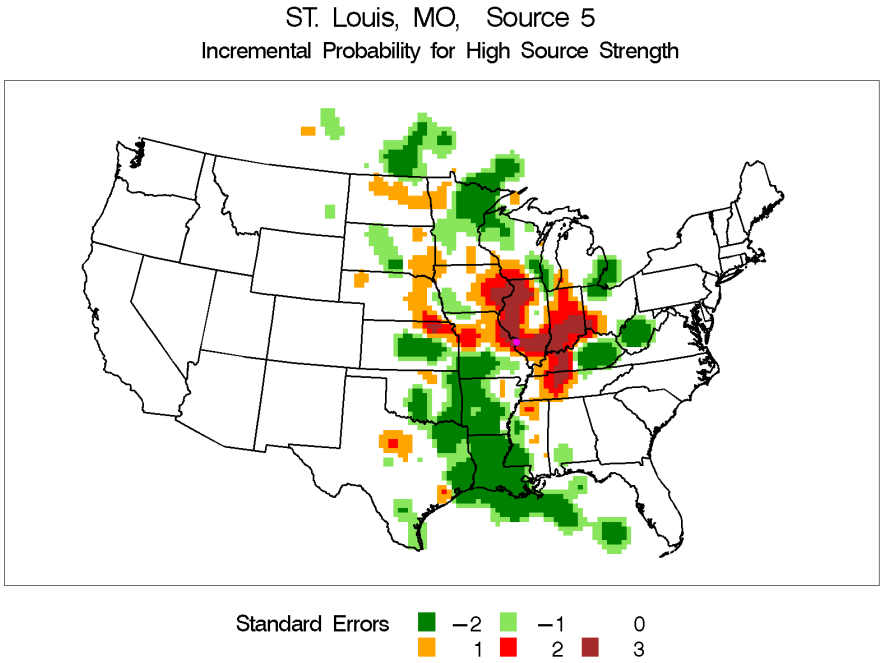

Figure J-28 Incremental Probability Contour Plot for St. Louis, Missouri, Source 5 - Ammonium Nitrate.

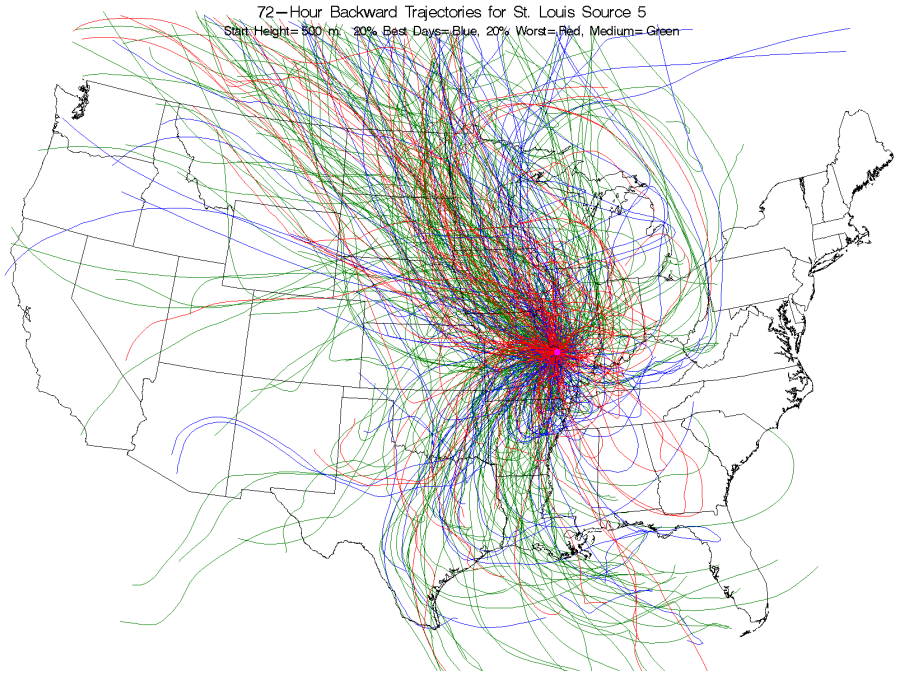

Figure J-29 Back Trajectories Color Coded by Source Strength Category for St. Louis, Missouri, Source 5 - Ammonium Nitrate.

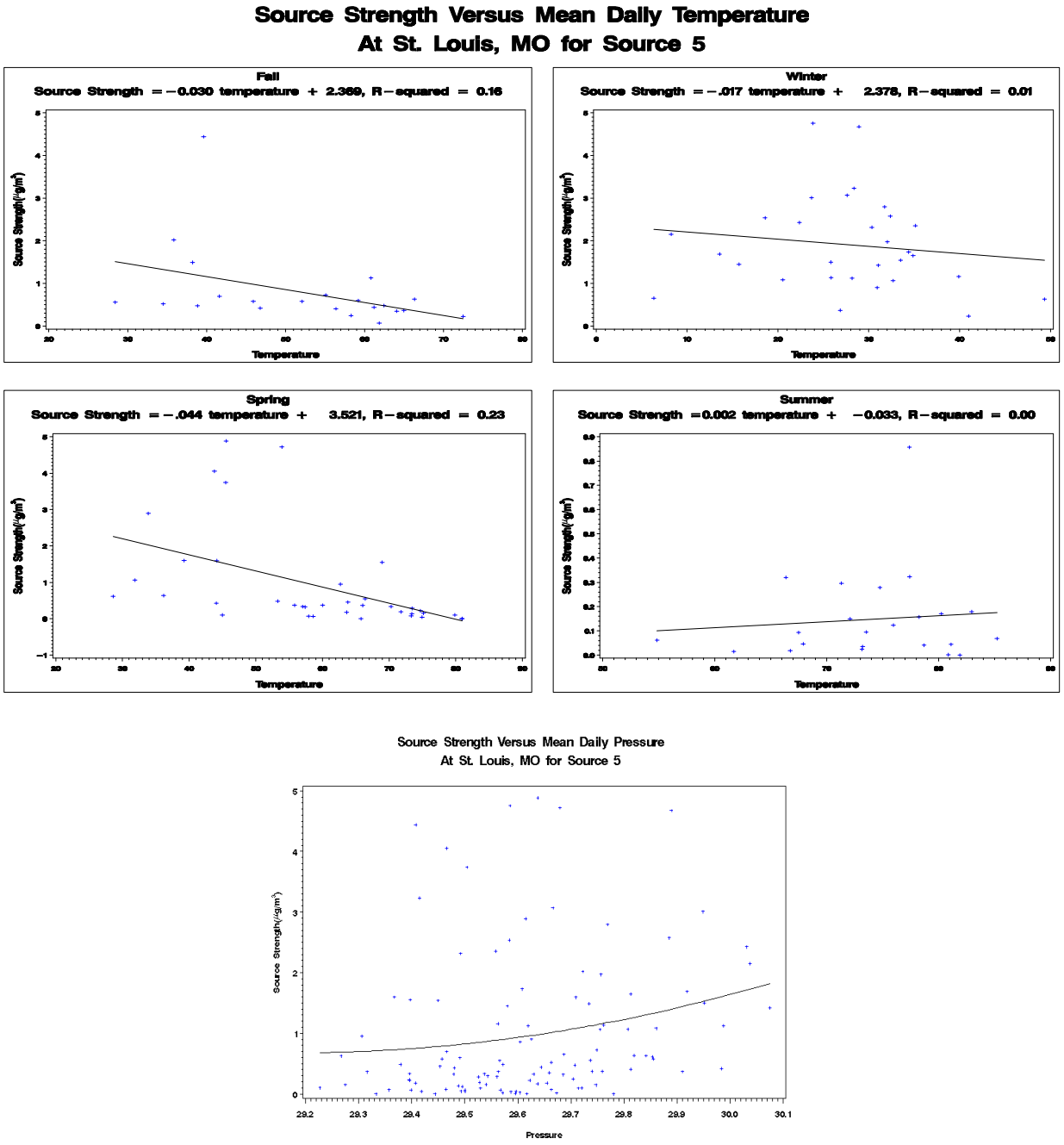

Figure J-30 Scatter Plot of Source Strength Versus Mean Daily Temperature (Rows 1 and 2) and Pressure (bottom) for St. Louis, Missouri, Source 5 - Ammonium Nitrate.

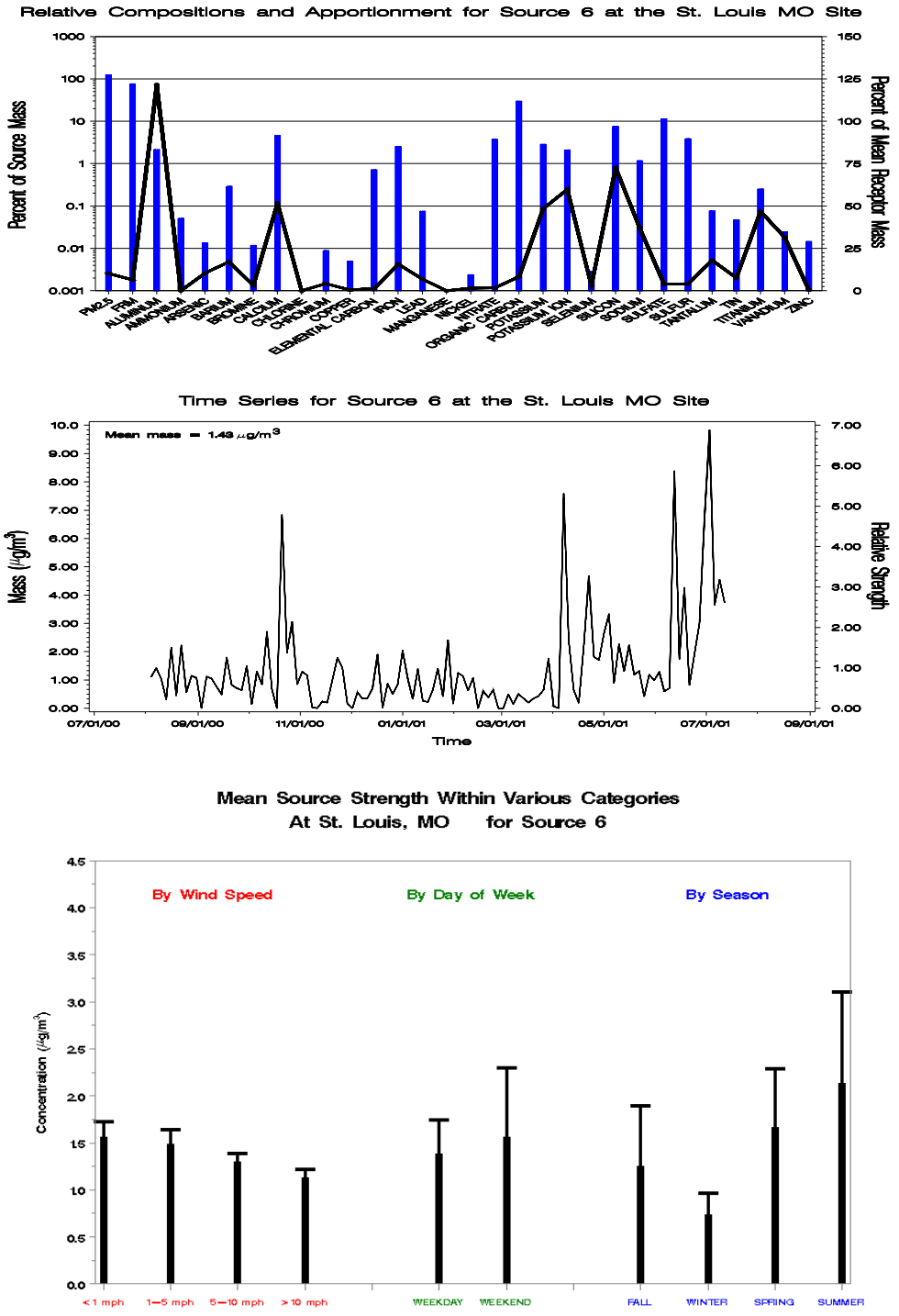

Figure J-31 Profile Plot (Top), Time Series Plot (Middle), and Bar Charts of the Source Strength Averaged by Wind Speed, Day of Week, and Season (Bottom) for St. Louis, Missouri, Source 6 - Crustal.

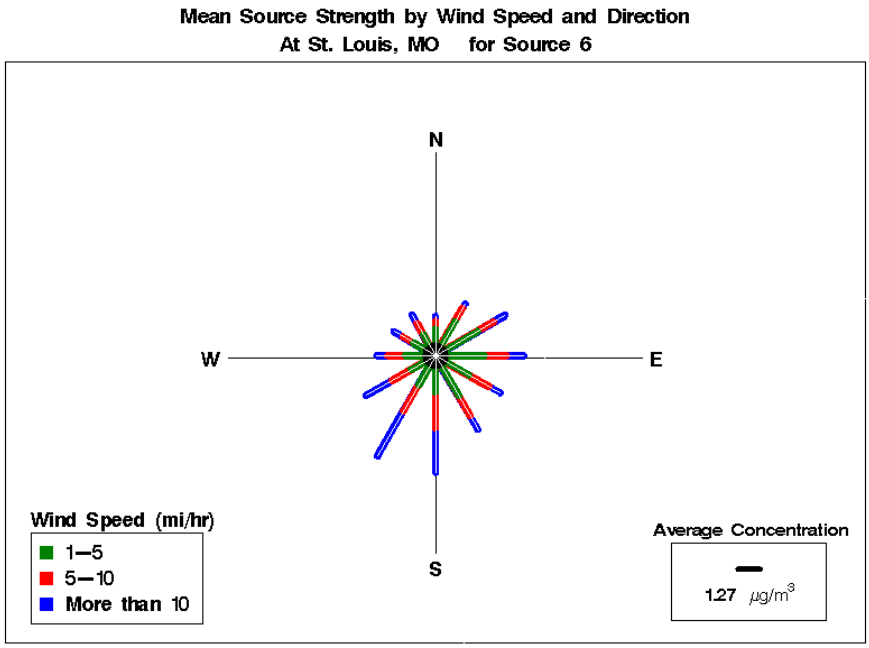

Figure J-32 Pollution Rose for St. Louis, Missouri, Source 6 - Crustal.

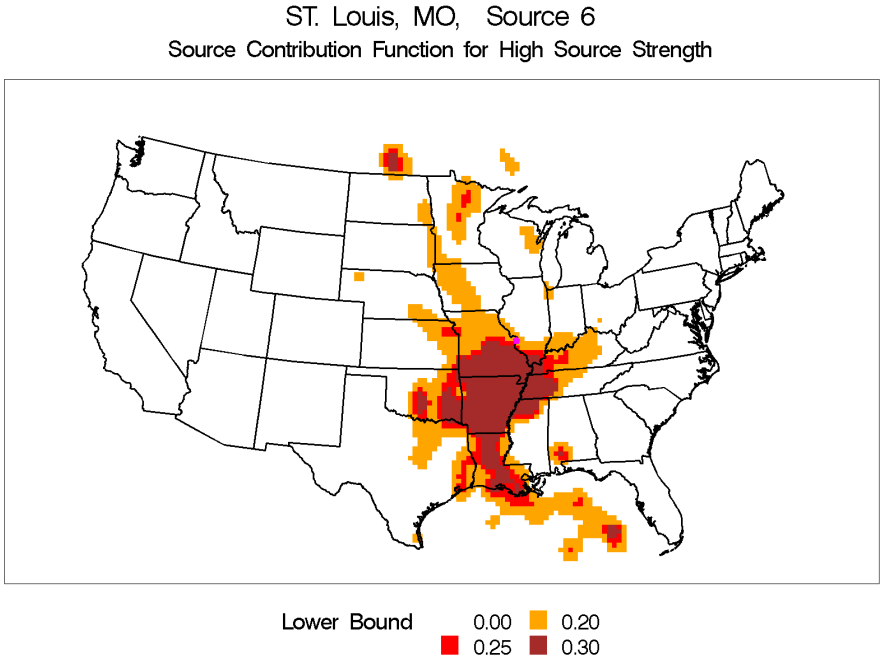

Figure J-33 Source Contribution Contour Plot for St. Louis, Missouri, Source 6 - Crustal.

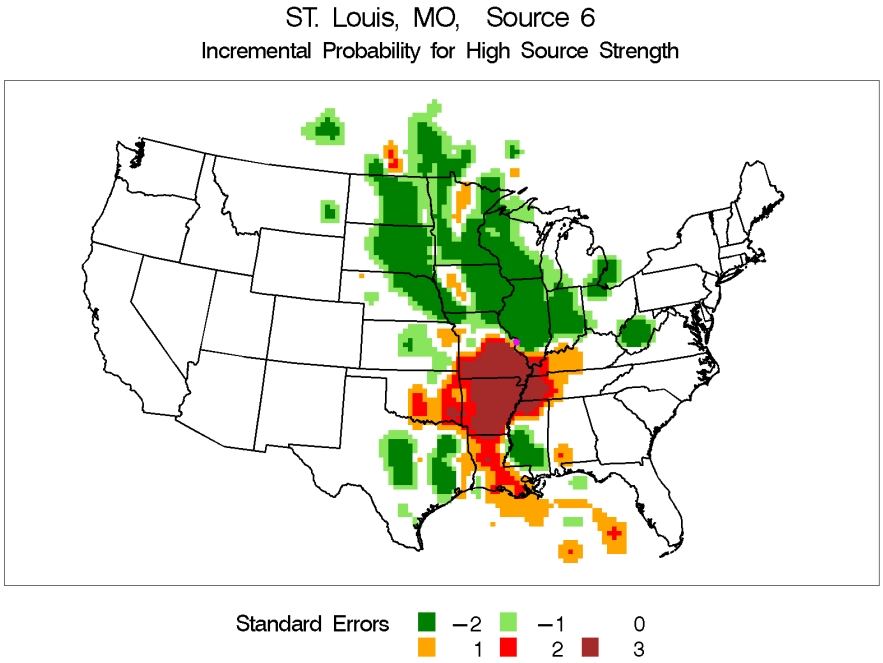

Figure J-34 Incremental Probability Contour Plot for St. Louis, Missouri, Source 6 - Crustal.

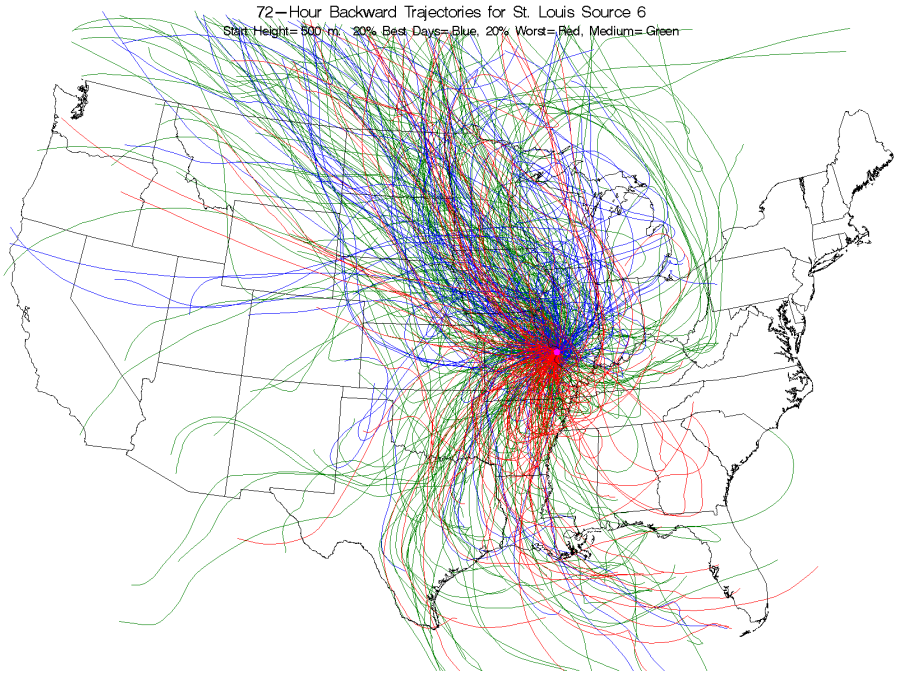

Figure J-35 Back Trajectories Color Coded by Source Strength Category for St. Louis, Missouri, Source 6 - Crustal.

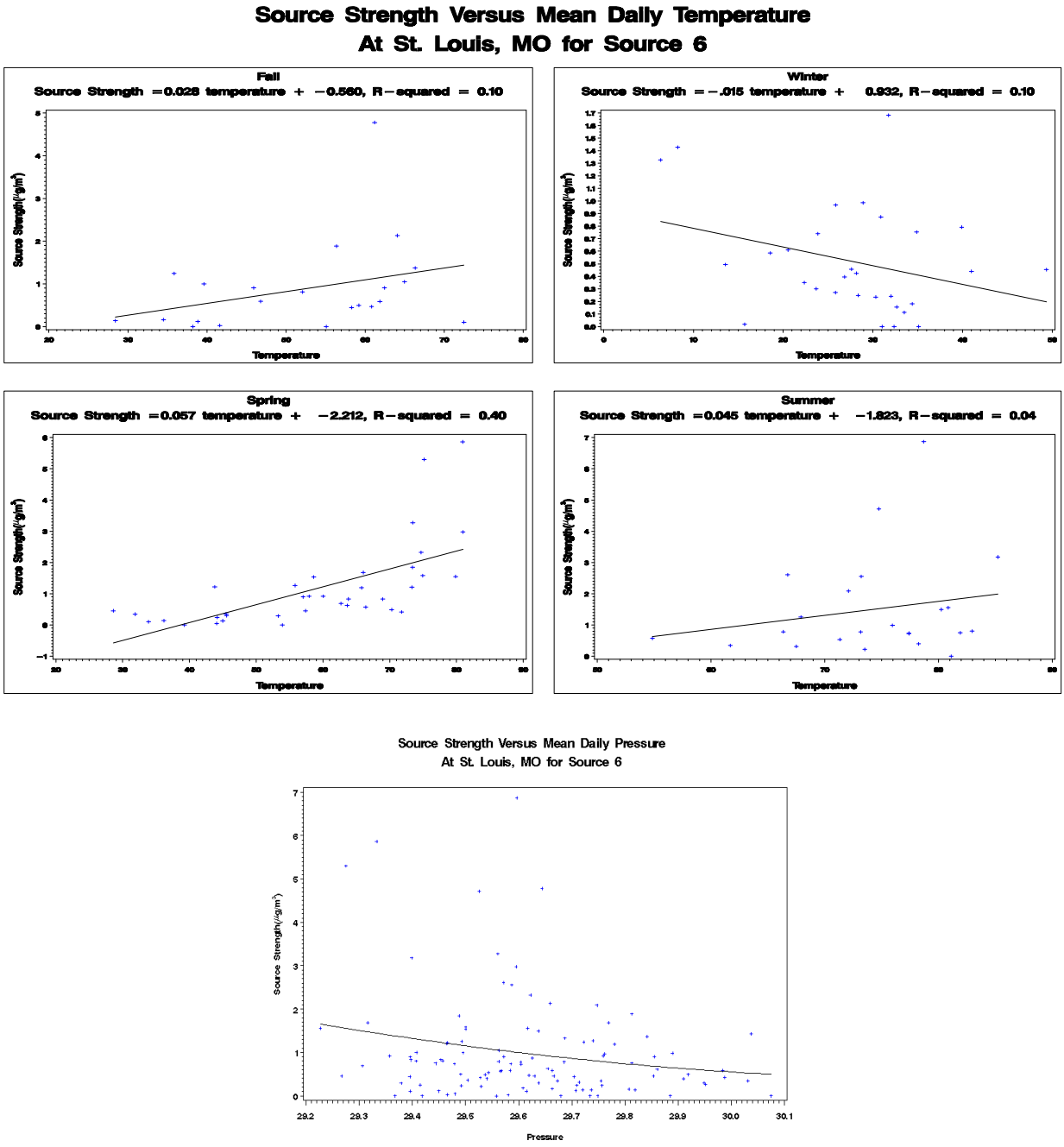

Figure J-36 Scatter Plot of Source Strength Versus Mean Daily Temperature (Rows 1 and 2) and Pressure (bottom) for St. Louis, Missouri, Source 6 - Crustal.

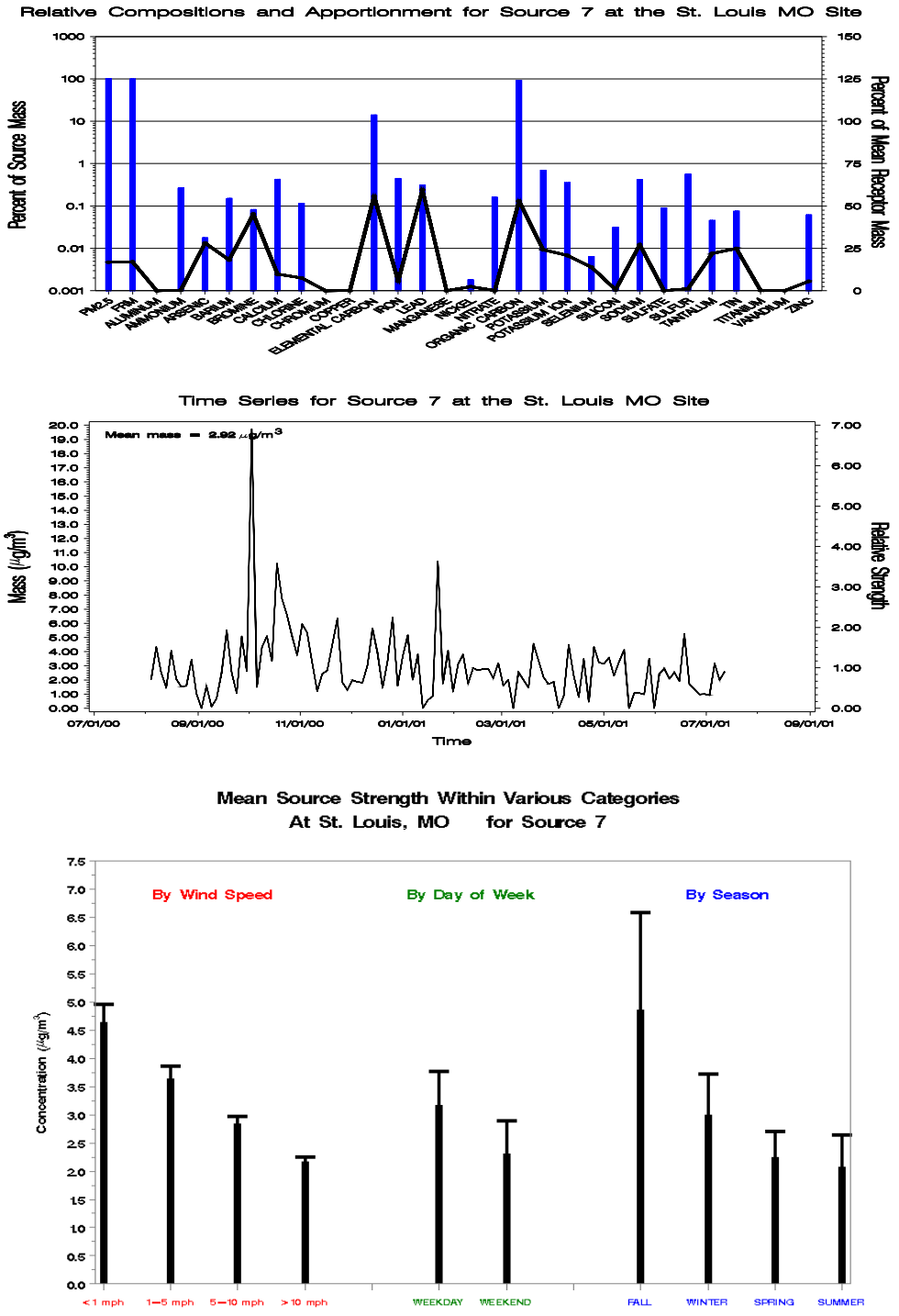

Figure J-37 Profile Plot (Top), Time Series Plot (Middle), and Bar Charts of the Source Strength Averaged by Wind Speed, Day of Week, and Season (Bottom) for St. Louis, Missouri, Source 7 - Mobile Sources.

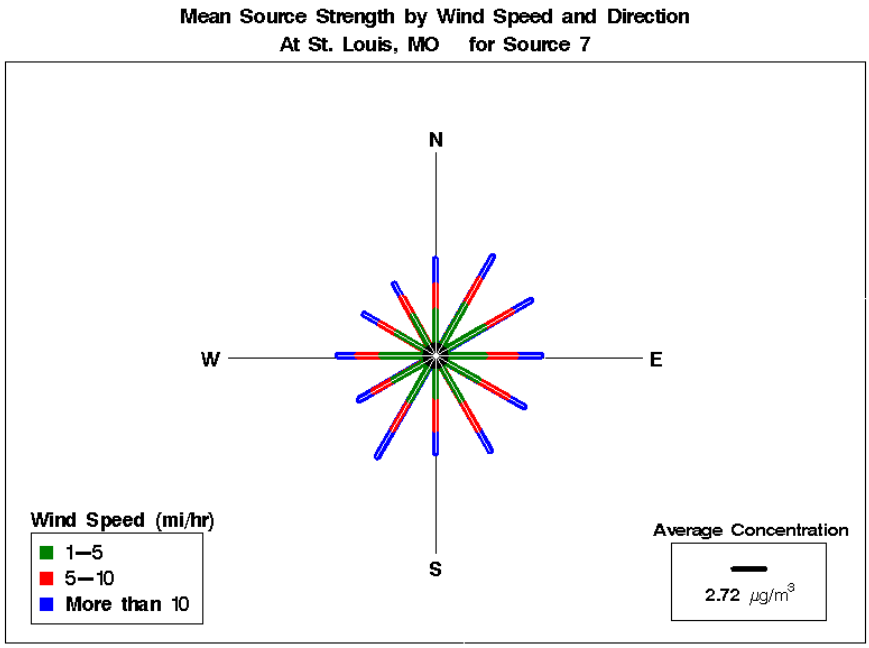

Figure J-38 Pollution Rose for St. Louis, Missouri, Source 7 - Mobile Sources.

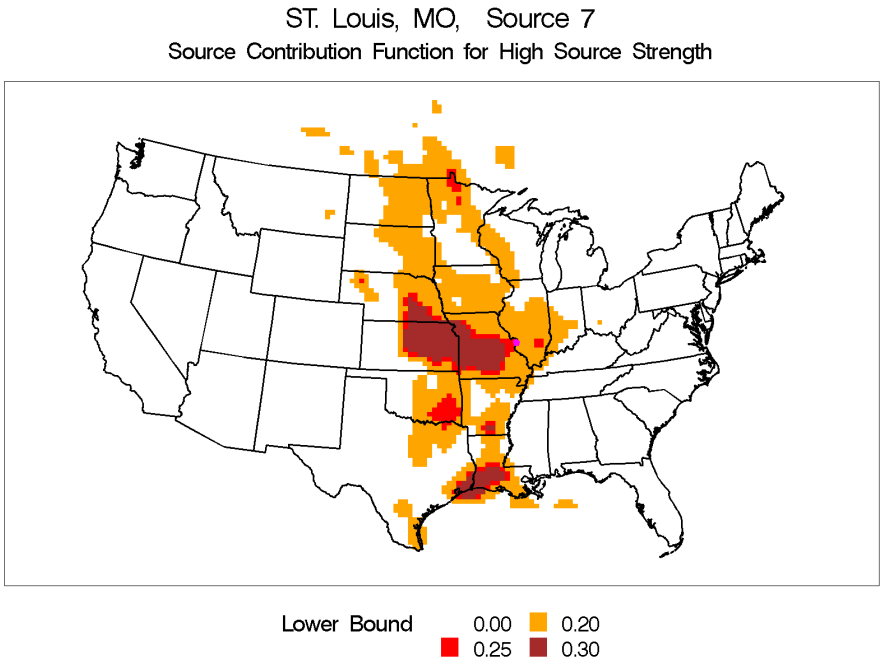

Figure J-39 Source Contribution Contour Plot for St. Louis, Missouri, Source 7 - Mobile Sources.

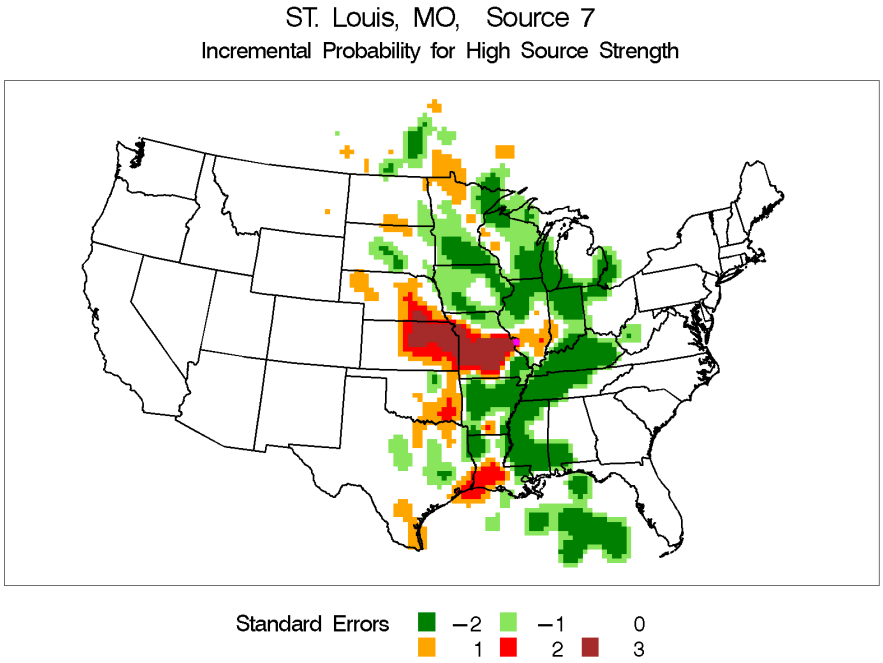

Figure J-40 Incremental Probability Contour Plot for St. Louis, Missouri, Source 7 - Mobile Sources.

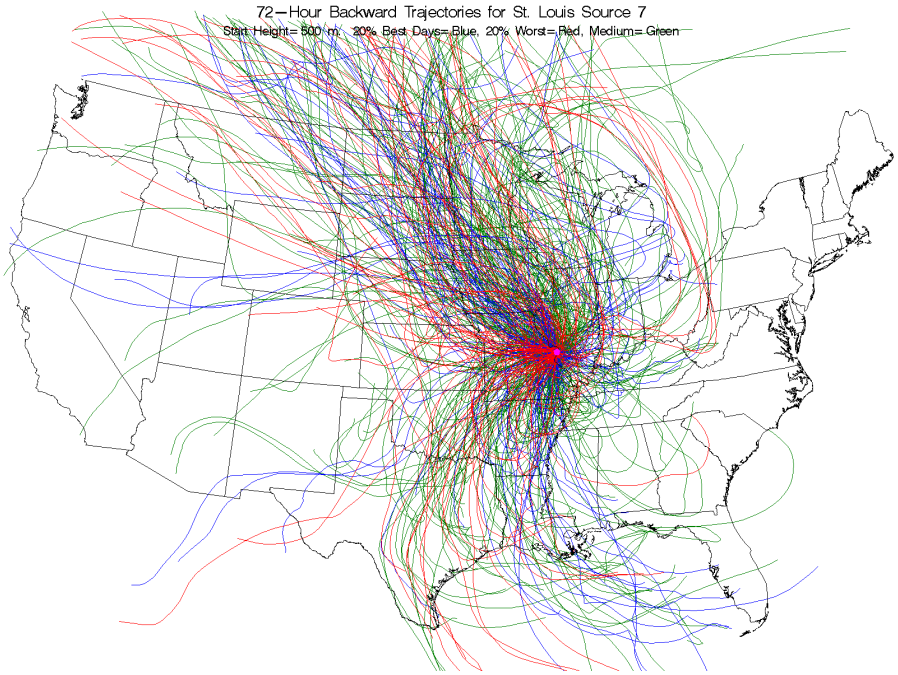

Figure J-41 Back Trajectories Color Coded by Source Strength Category for St. Louis, Missouri, Source 7 - Mobile Sources.

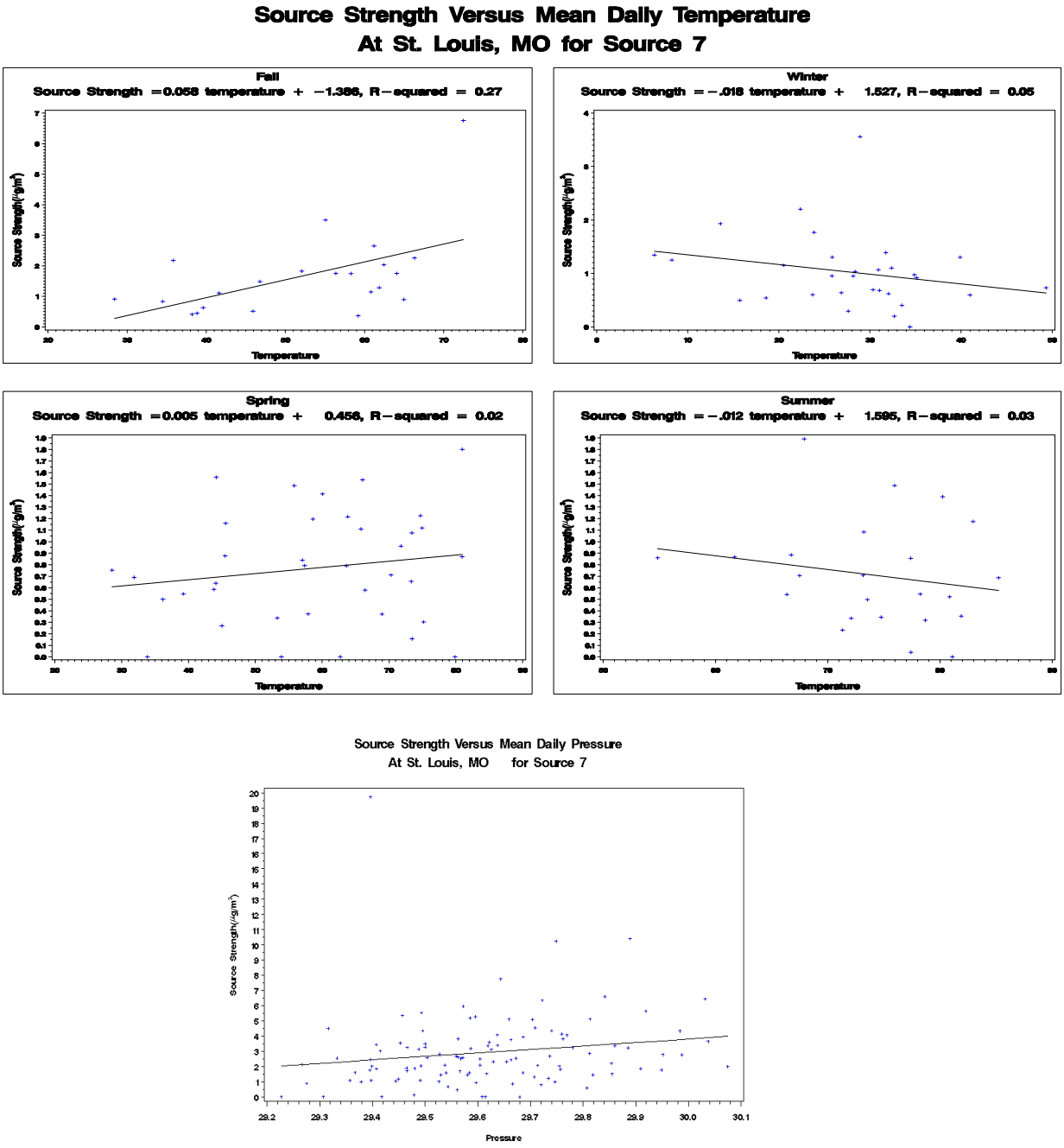

Figure J-42 Scatter Plot of Source Strength Versus Mean Daily Temperature (Rows 1 and 2) and Pressure (bottom) for St. Louis, Missouri, Source 7 - Mobile Sources.